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Field Test Plan: Electronic Collection Instrument (ECI) Field Trial and Beta Test

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BDM Federal, Inc.

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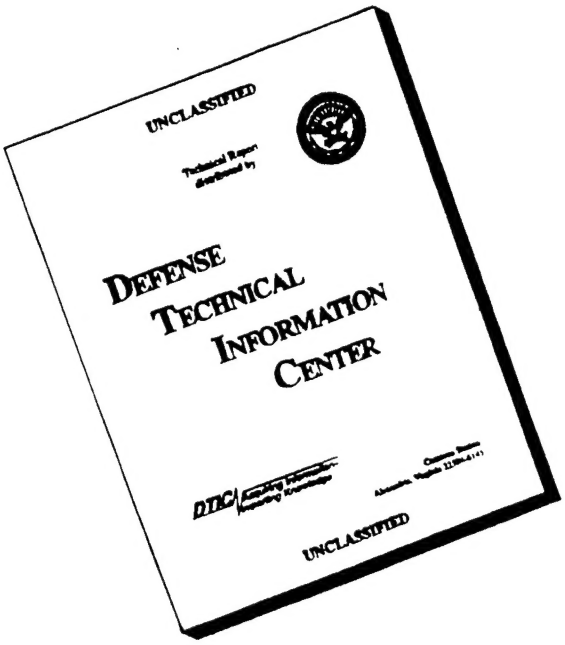

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The Army Research Institute is engaged in a research and development program sponsored by the Defense Institute for Training Resource Analysis (DITRA) designed to develop and test a prototype Performance Automated Measurement System (PAMS). The PAMS concept was derived from the requirement to improve the recording of field training data on the performance of soldiers, teams, and larger units by taking advantage of technological advances. PAMS was adopted by the U.S.Army in April 1993, and was subsequently renamed the Electronics Collection Instrument (ECI) for Army use.

This report summarizes the field trials conducted to determine the software and hardware capabilities and functions of a prototype ECI. One goal of the field trials was to conduct a joint test of the ECI under field conditions. A second goal was to have a broad base of users test the ECI in a field environment.

ACCESS field trials were performed to achieve those two objectives: First, to conduct the field trials with seperate DoD services, was achieved. The second, to have a broad base of users test ACCESS in a field environment, was achieved.

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FIELD TEST PLAN: ELECTRONIC COLLECTION INSTRUMENT (ECI) FIELD TRIAL AND BETA TEST

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U.S. Army Research Institute

Table of Contents

I. INTRODUCTION

A. Background:

The Army Research Institute is engaged in a research and development program sponsored by the Defense Institute for Training Resource Analysis (DITRA). This research is designed to develop and test a prototype Performance Automated Measurement System (PAMS). The PAMS concept was derived from the requirement to improve the recording of field training data on the performance of soldiers, teams, and larger units by taking advantage of technological advances.

The requirement for new systems and tools has been identified at both the Department of Defense (DoD) and the individual service level. To cite a few examples, the Army Science Board Training and Technology Report of 1985 calls for improved measurement of military outcomes; the General Accounting Officer in their report on the National Training Center described the need to extend the benefits of expensive collective training to a larger base; and the DoD Total Quality Management Plan supports this position by promoting the cost effective use of DoD training resources.

PAMS is an automated system for measuring performance with the capability to produce data collection instruments from a database library using a form authoring and editing system; collect and store quantitative and qualitative data including indexed narrative comments in the field; transmit the data to a centralized database for storage and analysis; generate data summaries and reports of unit performance; and produce data rollups across units. Key features of the PAMS project included a user oriented prototype development process and a broad base of users from the Armed Services communities representing users from operational units, combat training centers and simulation training facilities. PAMS was adopted by the U.S Army in April 1993, and it was subsequently renamed the Electronic Collection Instrument (ECI) for Army Use.

B. Objective:

This report summarizes the field trials conducted to determine the software and hardware capabilities and functions of a prototype ECI.

One of the goals of the field trials was to conduct a joint test of the ECI under field conditions. Accordingly, the field trials included participants from the U.S. Army and the U.S. Air Force. Field trials were conducted at the National Training Center (NTC), Fort Irwin, CA, the Joint Readiness Training Center (JRTC), Fort Polk, LA, and Nellis Air Force Base, Nv.

A second goal was to have a broad base of users test the ECI in a field environment. This goal was achieved, as described below. Overall, 103 soldiers and airmen (officer and enlisted) and civilians, from two separate DoD services, conducted field trials. These trials resulted in the ECI being used for 108 days in harsh and demanding field conditions.

II. FIELD TRIALS

A. NTC Field Trial (August 1993)

Coordination occurred in June 1993 with the NTC Operations Group to conduct field trials during the rotation scheduled for August. Six Observer-Controllers (O/C's) were selected to participate in the field trial. The O/C's were selected from two separate O/C Teams, with each O/C representing a different functional area (see APPENDIX A).

A two member BDM team visited the NTC 5-7 July to determine the NTC data collection requirements for the August field trial. The team met with the O/C's and was able to finalize and collect the checklists, statistical data tracking sheets, and the Take Home Package (THP) required by the O/C's. O/C's were provided with an overview on the ECI system and in turn provided the BDM team with capabilities they would like to see in the ECI (see APPENDIX B).

The O/C checklists, statistical data tracking sheets, and THP were to loaded into the ECI software by BDM at the Presidio of Monterey (POM). The process of integrating the O/C data collection forms into the ECI occurred 9-23 July. The ECI software was Beta Tested by three BDM employees 26-30 July; software bugs were identified and two programmers corrected them. By 30 July the ECI software program was completed and ready for field trials.

The ECI software used in the field trial was DOS/Character based, in Clipper/Advanced Revelation Language. The program was composed of two elements; a data collection module to be used in the field by the end user and a data assimilation/reporting module to be used in a 'home base' situation.

Four different off-the-shelf laptop computer brands were used during the field trial to compare hardware requirements and features. They were: two Sharp computers, model PC-6881; two portable Grid computers, model 2260; two Zenith computers, model Z-Lite 320L; and one Tusk, hardened 386 computer. All systems contained internal batteries and accessories, included battery chargers and power cables. O/C HMMWV's were modified in late July with a power plug to allow the computers to run off vehicles batteries. The power outlet also allowed for battery charging.

The O/C's received ECI training at the NTC 2-4 August by a three-person BDM team. Instruction was required because the ECI did not contain an internal tutorial. Training was conducted over a two day period, with one day of classroom instruction and one day of personal, one-on-one sessions. Instruction covered the ECI program and the data collection forms loaded in the ECI. At the conclusion of training the computers were distributed. Six systems were distributed to the O/C's and one (a Sharp) was retained as a backup. Each computer was configured to meet individual user checklist, THP, and statistics sheets requirements.

The ECI was tested under field conditions during a rotation at the National Training Center (NTC), Fort Irwin, CA, 7-21 August 1993. During the mid-rotation O/C break, a two-man BDM team conducted interviews with the O/C's to determine the ECI's performance over the first seven days. Results of the interviews are cataloged in APPENDIX B. The Tusk computer, the

only hardened system used, failed during the first half of the field trial and was replaced with the back-up Sharp computer for the remainder of the field trial.

B. August NTC Field Trial Results

Interviews were conducted with the O/C's at the end of the rotation (23-24 August) by a two-man BDM team. The results of the interviews are listed in APPENDIX B. In addition to verbal comments collected during the Interviews, the O/C's completed and turned in Questionnaires. The results of the questionnaires are listed in APPENDIX C. Overall, all O/C's indicated that the ECI had the potential to ease the work load as well as provide rapid data analysis. The O/C's also expressed that the ECI could assist in the presentation of training exercise After Action Reviews (AAR's) to the rotational unit through the ECI's ability to rapidly access collated data.

III. HARDWARE

Although the ECI program is software oriented, hardware considerations were reviewed to determine the best platform for ECI. The use of off-the-shelf computers resulted in trials being conducted with only one hardened system (Tusk). Although the Tusk failed, the trial provided valuable information on hardware features required in computers to perform for data collection in a field environment.

Field trials determined that the hardware must be easy to assemble and not require a large amount of space. Electronic data collection systems which require time to assembly and disassemble and sizeable space for use impose a burden on the user and increase reluctance to use the system.

Throughout all field trials, users stressed that the ECI should be assembled and mounted instead of being stored. This configuration allows the user to rapidly turn on the system, input data, and quickly shut the ECI down. Without a pre-configured system available for rapid use, O/C's are required to spend time assembling and disassembling the system. During the trial, the computers were stored in a metal carrying case for protection, opened and assembled when required.

In addition to the hardware specifications listed above, O/C's provided the following information:

1) The system should be hardened to allow use in a variety of field conditions and environments.

2) The system should have an internal disk drive, and should not require additional attachments or accessories which require time for assembly and disassembly.

3) The hardware needs to be connected to the vehicle power source in a manner that does not result in vehicle battery power drains.

4) Screen contrast adjustment is necessary to allow reading in sunlight and to reduce the light signature at night.

IV. SOFTWARE

The field trials provided important information on additional software capabilities and functions required for easy and rapid data collection. The guiding principles behind modifications were to ensure that the ECI software was user friendly and could provide real and specific benefit. The input of and access to data had to be accomplished quickly for use during AAR's, briefings, or in the development of reports and trends.

The major software recommendations identified by the field trial participants are as follows:

1) Word processing program with copy, cut and paste, spell check, and word wrap capability.

2) Graphics User interface software to allow operating with multiple screens or windows and to create graphs, charts, and spreadsheets.

3) Help program to train users and resolve questions during system use.

4) A method to move from different checklists or data collection forms, utilizing an icon based system and a menu bar common to all data collection forms.

A. ECI modifications and refinements (August 1993 - January 1994)

Based on feedback and analysis of the ECI field trial, a re-write of the software into Graphical User Interface and Windows was necessary. The rewrite provided the ECI with interconnectivity to and communication with other Windows based programs, such as spreadsheets, databases, and word processing programs.

The updated software program provided advantages through operating in a Windows programming environment. The advantages included access to Windows program-to-program interconnectivity tools and access to Visual Basics incorporated data handling and reporting tools. These advantages allowed the ECI to provide additional capabilities identified as being needed during the August NTC field trial.

A separate software program was written to integrate doctrinal FM's and ARTEP MTP's into the ECI through an ARTEP Reader. The ARTEP Reader provided users access to doctrinal manuals for review and allowed "cut and paste" from manuals to data collection forms.

The software rewrite was performed by one programmer and required twelve weeks. A second programmer monitored the re-write and provided assistance. The ARTEP Reader was developed by a third programmer and required six weeks to complete.

B. ECI field trial preparation and Beta Tests (February - March 1994)

Coordination was made with JRTC and NTC in January 1994 to schedule field trials. BDM-Fort Polk conducted coordination with the JRTC Operations Group and NTC Observation Department (NOD) coordinated with the NTC Operations Group. The purpose of field trials was to demonstrate and test the updated ECI software program and to expand the base of participants. Coordination resulted in the determination of field trial participants, field trial schedule, and data collection requirements.

V. JRTC

The JRTC Operations Group directed that data collection would be based on the JRTC "Green Books". In addition to Green Book data collection, JRTC directed that O/C's be provided the capability to construct their own data collection forms. Field trial data collection was scheduled for the March 1994 rotation. Sixteen O/C's (ten primary and six alternate) were selected to participate in the trial from various teams within Operations Group (see APPENDIX A).

A second field trial was conducted concurrently with the JRTC O/C field trial. Three ECI's were utilized for data collection in support of the "Systems For An Interservice Exercise Measurement and Feedback System (SINEX)" project. Data collection was based on SINEX Task Lists. Five participants (U.S. Air Force, BDM and PRC representatives) were involved in the SINEX data collection effort (see APPENDIX A). The SINEX and JRTC O/C data collection efforts, although conducted concurrently, were separate field trials due to the type and nature of data collected.

VI. NTC

The NTC Operations Group directed that data collection be based on "Digital Difference Cards". The Digital Difference Cards were developed to support DESERT HAMMER VI, an Advanced Warfighting Demonstration designed to explore the impact of digital command and control on the modern battlefield. To provide usable data in support DESERT HAMMER VI, the NTC Operations Group directed that the ECI's be used to collect data over three rotations, from March to May 1994.

Data collected by the ECI's were transferred and incorporated into the DESERT HAMMER VI SPSS/FOXPRO database. ECI software was modified to allow downloading into SPSS and FOXPRO. NTC scheduled forty O/C's to participate in the data collection effort: twenty from the Armor Task Force Training Team (COBRAS) and twenty from the Task Force Live Fire Training Team (DRAGONS) (see APPENDIX A).

A. Data Collection Forms

BDM was required to load the Green Books, the Digital Difference Cards, and the SINEX Task Lists into the ECI based on data collection requirements from JRTC, NTC, and the SINEX Project. Loading of the required collection forms for the three trials was performed by four people and required four weeks. The loading was completed at the end of February 1994.

Nine separate JRTC Green Books were loaded into the ECI. BDM-Fort Polk loaded three Green Books and BDM-POM loaded six Green Books. Forty-six NTC Digital Difference Card were loaded into the ECI by BDM-POM. To support the SINEX Project, seventeen Task Lists were loaded into the ECI by BDM-POM.

After each data collection package was loaded into the ECI five BDM-POM people conducted Beta Testing. The Beta Test of each package (JRTC, SINEX, and NTC) was phased, i.e. when the Green Books were completed, the package was Beta Tested. Beta Testing of the ECI with JRTC, NTC, and SINEX packages required two weeks.

Software problems encountered in the Beta Tests were associated primarily with the loading of the individual data collection forms. Field names and structure of the forms required extensive supervision and management to correct errors. Beta Testing also focused on the ECI's program to download data into the NTC DESERT HAMMER VI database.

B. ECI Computer Platform

In January one common computer model was selected to serve as the ECI platform. This decision was made to facilitate user training, reduce hardware costs, and streamline hardware repair requirements. A review of off-the-shelf portable computers was performed by ARI and BDM-POM, and the Dauphin DTR-1 was selected. The DTR-1 was selected based on the following capabilities:

1) A 486 SLC 25 MHz microprocessor.

2) 6 MB of dynamic RAM.

3) Built-in 40 MB Hewlett-Packard hard drive.

4) Physical characteristics: dimensions of 9" x 5 1/2 " x 1 1/4"; weight of 2 1/2 pounds.

5) Pen based, with pre-installed Windows for Pen Computing.

Forty Dauphin DTR-1's were purchased and configured with NTC, JRTC, and SINEX data collection forms. Loading and configuration required five days and occurred from late February to early March.

The NTC and JRTC field trials overlapped during March 1994, requiring 54 computers to support all scheduled trials. A distribution plan was developed to support the March field trials with the forty DTR-1's available.

Fifteen computers were provided to JRTC. Ten systems for JRTC O/C's, three systems for SINEX Project data collectors, and two back-up systems as replacements.

Twenty-five systems were provided to NTC. Twenty systems were provided to the COBRA Team, turned over to the DRAGON Team as the rotational Armor Task Force transitioned to the DRAGON Team for Live Fire, and returned to the COBRA Team when the Armor Task Force returned to the COBRA Team at the conclusion of Live Fire. The NTC requirement to have forty users participate in the March field trial was satisfied by this distribution plan. Five systems were available as back-ups.

At the conclusion of the JRTC March field trials, their fifteen computers were delivered to NTC. With all forty ECI's at the NTC, the COBRA and DRAGON Teams each had twenty systems available for use during the April and May trials. With all ECI's distributed in April and May, priority was given to the on-site repair of the systems in the event of computer hardware breakdowns. If on-site repair could not be accomplished, the DTR-1 was returned to the manufacture for repair and the user either reverted to the manual data collection system or doubled-up with another field trial participant to input data.

C. ECI Interface with OCCS

The NTC and the JRTC Operations Groups both identified the need to have ECI collected data transmitted over the Observer-Controller Communications System (OCCS).

The JRTC identified that transmission of data from the field to the Training and Analysis Feedback (TAF) Center would allow for rapid analysis and feedback to the JRTC leadership. Additionally, since O/C's operate predominately without full time vehicle support, they would not be burdened with the time- and resource-consuming requirement to consolidate and physically deliver collected data to the TAF. Without a transmission capability, O/C's would either transfer

data to the TAF by diskette on a scheduled basis or the data would remain in the O/C's ECI's and not downloaded until the end of the rotation.

The NTC's concerns, similar to the JRTC's, also included the rapid transmission of data for integration of data into the DESERT HAMMER VI data base. With the Advanced Warfighting Demonstration at NTC designed to explore the impact of digital systems on the modern battlefield, NTC also desired to take advantage of technological advances to test systems which would advance the CTC's performance capabilities.

Due to the length of the field trials scheduled (three months), the desire to apply advanced technology to enhance CTC performance, and the proximity to BDM-POM, the NTC was selected as the trial site to test transmission of data over OCCS.
Successful transmission over OCCS, although untested, would further enhance the utility and usefulness of the ECI to users.

In late January coordination was made by BDM with representatives from High Desert Communications, the agency with the NTC OCCS support contract. High Desert Communications indicated that Radio-Data Interfaces (RDI's) would allow the ECI to interface directly with the OCCS, and BDM initiated a purchase of RDI's. Due to inventory and shipping problems, High Desert Communications was unable to provide the required RDI's and associated cables prior to the first scheduled field trial in March. Finally, it was learned that the RDI's would not work with off-the-shelf software (a DITRA requirement).

In late February modems were selected to link the ECI with the OCCS based on the RDI problems. On-going coordination with High Desert Communications determined that two companies (Comtronix Communications and Advanced Digital Sensing Laboratories[ADSL], working jointly, had previously achieved success with transmitting data by modem over OCCS. Both companies manufacture the modems utilized with the OCCS.

Coordination was initiated with representatives from Comtronix and ADSL, and a meeting was conducted at the NTC on 11 March. The purpose of the meeting was to successfully demonstrate the transmission of ECI files over OCCS via modem. NTC supported the initial test by providing an OCCS base station and an OCCS-equipped vehicle. Two days were spent testing the ECI-modem-OCCS connectivity; eventually files smaller than 2k bytes were transmitted. Hardware modifications to two modems were required and performed by the Comtronix and ADSL representatives. Documentation on software and hardware modifications was provided to BDM by Comtronix and ADSL.

Due to the size of the ECI files, it was necessary to conduct further tests to increase file size and reliability of data transmission. ECI and modem software was purchased and configured in mid-March. Continued testing was not possible until early April due to the March NTC rotation and restricted access to OCCS systems.

On 8 April a three-person BDM team conducted further testing at the NTC. The intent of the testing was to replicate the success achieved in March with the transmission of data over OCCS, to test the transmission of larger files, and to prepare five modems and the OCCS for use during the April rotation. The team was unable to replicate the transmission test using the

hardware and software documentation provided by Comtronix and ADSL. A phone conversation with the Comtronix representative revealed that the hardware and software documentation provided earlier was incomplete.

The BDM representative providing on-site technical support for the NTC April rotation, 10-23 April, continued to work the software and hardware issues. By 20 April success had been achieved in transmitting ECI files by modem over OCCS. To accomplish this, the Digital Difference Card size had to be compressed. Several files were successfully transmitted during the test, with all Digital Difference data received and loaded into the DESERT HAMMER VI SPSS/FOXPRO databases. Although the transmission of ECI data had been achieved during controlled testing, no O/C field trials were conducted.

D. JRTC Field Trial (March 1994)

The ECI was tested under field conditions at the Joint Readiness Training Center (JRTC), Fort Polk, LA, 11-29 March 1994. A two-man BDM team conducted training for and provided assistance to the O/C participants during the period 7-10 March. Training was performed in a classroom environment over a two day period. Each O/C conducted training with the ECI they would use during the trial. Following formalized classroom training, individual one-on-one training was conducted with each participant.

Sixteen Army O/C's were trained; ten primary and six alternate users. Training focused on ECI assembly and use, the Green Book programs, and the MTP Reader. O/C's were also instructed on the form developer to satisfy the JRTC's requirement for O/C's to construct their own data collection forms. Four participants in the SINEX Project were also trained; three Air Force and one contractor. The ECI's were distributed following the training. Of the two back-up systems, one failed prior to the field trial and was returned to the manufacture.

During the field trial, on-site technical support was provided by a representative from BDM, located in the JRTC TAF. The on-site technician provided programming and hardware support throughout the field trial. Of the fourteen DTR-1 computers available and used during the field trial, two systems failed and were returned to the manufacture.

At the conclusion of the rotation, the on-site technician assisted O/C's in downloading collected data as well as formatting the collected data into the report writer program. BDM-Fort Polk, due of their association with the JRTC Operations Group, analyzed the field trial and published an after action report covering the JRTC O/C participation (see APPENDIX D).

Based on JRTC O/C comments, ECI hardware concerns were:

1) The computer must be ruggedized and have a long battery life to allow for extended use away from a vehicle power source.

2) For O/C's at higher echelons (company and higher), a computer with greater processing speed, sufficient RAM and storage space to accommodate additional software, and a larger key board (perhaps attached to the computer itself) is required.

3) Contrast adjustments made to reduce the light signature during the night rendered the screen unreadable.

ECI software concerns were:

1) Handwriting recognition software needs to be implemented.

2) More easily used software for the development of individual data collection forms and records is required.

3) Map and graphics applications, which allow maneuver and operational graphics to be drawn onto a map, are required.

4) The software needs to allow the production of graphs, charts, and slides for use during AAR's and in data analysis.

5) The ARTEP Reader has great potential, provided applicable FM's and ARTEP's could be loaded.

The ECI's used in the SINEX Project field trial were unable to fully support the data collection effort. Problems were experienced with the ECI database software. Due to an error in the software program, files were unable to contain all the data collected from the start to the end of the rotation. The ECI's were able to retain files for half the rotation, forcing the remainder of the exercise to be performed with manual data collection systems. Data that was collected in the ECI, although not covering the entire rotation, was satisfactorily downloaded into the SINEX database.

E. NTC Field Trial (March - May 1994)

The ECI was tested under field conditions at the National Training Center (NTC), Fort Irwin, CA, during three rotations between March and May 1994. Field trial dates were 6-19 March, 10-23 April, and 8-21 May. Field trial data collection during this period was in support of DESERT HAMMER VI, as described above.

O/C training and equipment distribution were performed by a three-person BDM team 28 February to 3 March. Training was performed in a classroom environment over a two day period. One day each was dedicated to training the COBRA Team and the DRAGON team. Each O/C trained used the ECI they would have during the trial. Following formalized classroom training, individual one-on-one training sessions were conducted with each participant. Forty O/C's were trained, twenty from each team. Users were instructed on the assembly and use of the ECI, the Digital Difference Card programs, and the MTP Reader.

Several ECI software features, known prior to the start of March field trial, were expected to be raised by the O/C's as concerns. O/C's were briefed on these features, which were:

1) System was not hardened to operate in the NTC field environment.

2) Internal computer batteries did not hold charges longer than two hours.

3) Down-loading of data is accomplished one card at a time and only when the card is opened; need to have the capability to download multiple cards at one time.

4) Help function was not fully activated and accessible throughout all programs.

On-site technical support was provided during the March field trial by a representative from BDM, providing programming and hardware support. On two occasions the on-site technician went to the field to interview O/C's on the ECI's performance as well as to provide replacement components. Data collection was performed by thirty-seven O/C's; three O/C's were not required to collect data on the Digital Difference Cards. Of the twenty-five DTR-1 computers used during the March field trial, two systems failed. The systems were replaced with back-up systems, and the failed systems were returned to the manufacture for repair.

Software and hardware problems identified during the trial were corrected by the on-site technician. During interviews with each user throughout the rotation, the technician was able to assess ECI performance and respond immediately to any identified bugs or problems. Those software problems which affected all ECI systems were cataloged and the software program was modified to correct the fault. Due to the intensity of the field trial, software updates required for all systems were scheduled to occur at the end of the rotation.

At the conclusion of the March field trial, all ECI's were collected. By consolidating all computers, BDM programmers were able to update the software, integrate the Access received from JRTC, and reconfigure the systems to match the individual O/C Digital Difference Card requirements. The integration of the JRTC systems raised the number of Access to thirty-five (five were non-operational).

Interviews with the O/C's were conducted at the conclusion of the March rotation to determine ACCESS software and hardware performance. During these interviews numerous small bugs, predominately dealing with saving and down-loading data, were identified. Problems were also experienced with the downloading of data into the DESERT HAMMER VI SPSS/FOXPRO database. These software bugs were catalogued and corrected during the break between the March and April rotations, from 23-31 March.

Refresher training for O/C's was performed 4-8 April. Digital Collection Cards, the ARTEP Reader, and software modifications were reviewed. O/C's utilized their re-configured Access during the training, and signed for their systems at the conclusion of training. The Commander - Operations Group (COG) requested one ACCESS for display purposes, and his driver was trained on the system.

During the April field trial, on-site technical support was provided by a representative from BDM. The on-site technician was located in the NTC NOD building and provided programming and hardware support. Since data transmission over the OCCS was not performed during the field trial, BDM provided physical support to facilitate the collection of data for integration into the DESERT HAMMER VI database. The BDM technician met with O/C's in the field following each mission, picked up ACCESS diskettes which contained the mission data,

and transported the diskettes to the DESERT HAMMER VI Analysis Cell for downloading. While meeting with the O/C's, the on-site technician also provided assistance, support, and component exchange.

Although thirty-five systems were issued for the April field trial, active data collection was performed by only thirty-two O/C's. Eight of the forty O/C's did not collect data, either because they did not have collection requirements or because of a lack of time or interest. The COG demonstrated the ACCESS to the U.S. Army Chief of Staff at the end of the rotation.

Following the April field trial, interviews were conducted with the users. Interviews covered the Access ability over two rotations to collect and transfer data into the DESERT HAMMER VI data base. In addition to the interviews, O/C's completed questionnaires highlighting ACCESS performance; thirty questionnaires were received (due to the number of questionnaires received, they are not provided in this report).

The O/C's did cite concerns with the software features briefed during the March training sessions, listed above. Additionally, O/C hardware and software comments based on two months of field trials were:

1) Difficulty in reading the screen during the day and a light signature during darkness which could only be corrected by reducing the contrast, making the screen unreadable.

2) Too many component and accessory parts, requiring both room and time to assemble which the O/C usually does not have (ideally, ACCESS should pre-configured in a mount).

3) Some Digital Difference Cards would lock on one page, requiring the user to exit and re-enter the form. Also, there is a need to speed up the movement between pages of a card.

4) Difficulty was experienced in downloading some of the cards.

5) Although the program was configured to initialize on turbo speed, occasionally it would drop to slow speed.

6) Capability to refer to a pre-loaded common comments file; cut/paste and movement between multiple windows or cards was not user friendly.

Although the O/C's did not express a time or effort savings between collecting data with the ACCESS versus a manual collection system, time savings potential existed in the downloading of information into the DESERT HAMMER VI data base. The average time required by DESERT HAMMER VI Analysts to input one manual Digital Difference Card into SPSS/FOXPRO was five minutes. With forty-six cards digitally loaded into the ECI by the O/C's, there was a potential time savings of 3.8 hours per TF per mission.

The ECI's were collected from the O/C's at the conclusion of the April end of rotation interviews. The software modifications required to correct the problems identified above that were not implemented by the on-site technician during the rotation were performed between 25 April to 3 May.

The NTC Operations Group lifted the requirement to have the COBRA and DRAGON Teams use twenty Access each during the May field trial, instead allowing each team to use as many Access as they wanted to. As a result, thirteen Access were issued.

No refresher training was conducted with the NTC O/C's prior to the May field trial, O/C's felt familiar with the system. On-site support was provided by the BDM representative stationed at Fort Irwin. Since data transmission over OCCS was not conducted, the O/C's continued turning in diskettes at the conclusion of each mission through their TAF to the DESERT HAMMER Analysis team.

At the conclusion of the May field trial, the Access were collected and transported to BDM-POM for data download and preparation for the NTC-Nellis AFB field trial scheduled for June 1994. It was discovered that although thirteen ECI's were issued to O/C's, only six were utilized for data collection during the May field trial. Interviews with the O/C's were conducted at the conclusion of the trial for feedback on the Access performance, however no new issues or problems were identified.

F. NTC/Nellis AFB SINEX Field Trial (June 1994)

Four ACCESS systems were used to collect Task List data for the SINEX Project 5-18 June. Three systems were used at Nellis AFB for data collection by Forward Air Controllers (FAC's), and the fourth system was used at the NTC by the Test Manager. The field trial was performed during the June NTC rotation.

The FAC's at Nellis AFB were able to effectively use the ACCESS software to collect data. The ACCESS was able to support data collection and data transfer for the SINEX Project without any problems. Although the physical collection of data with the ACCESS did not result in significant time saving when compared with a manual data collection system, substantial time was saved in the loading of data collected into a database. A total of 12-13 hours of data entry time was saved by the use of the ACCESS.

VII. CONCLUSION

ACCESS software has undergone substantial modifications due to the experience gained over four field trials. Field trials were concentrated at the NTC, JRTC, and Nellis AFB, where a broad base of users from the U.S. Army and U.S. Air Force participated in the field trials.

The extent of ACCESS field trials can be broken down as:

SITE	DATES	DAYS	USERS
NTC	7-21 Aug 93	14	6
JRTC	11-29 Mar 94	19	10
JRTC	11-29 Mar 94	19	4 (SINEX)
NTC	6-19 Mar 94	14	37
NTC	10-23 Apr 94	14	32
NTC	8-21 May 94	14	6
NTC/Nellis	5-18 June 94	14	8 (SINEX)
		----	----
		108	103

ACCESS field trials were performed to achieve two objectives. The first, to conduct the field trials with separate DoD services, was achieved. Ten U.S. Air Force members, Colonel to MSG, used the ACCESS for thirty-three days in field trials conducted at the JRTC and Nellis AFB. Fifty-three U.S. Army members, Colonel to SFC, used the ACCESS for seventy-five days in trials conducted at the NTC and JRTC.

The second field trial objective, to have a broad base of users test the ACCESS in a field environment, was achieved. A total of 103 soldiers and airmen (officer and enlisted) and civilians, conducted field trials. These trials resulted in the ACCESS being used for 108 days in harsh and demanding field conditions.

No additional ACCESS field trials are scheduled to occur before the conclusion of the ACCESS Project. The information obtained during the 108 days of field trials is being used to complete the final software modifications.

APPENDIX A:
FIELD TRIAL O/C BREAKDOWN

APPENDIX A: (FIELD TRIAL O/C BREAKDOWN)

A. August 93 NTC Field Trial O/C breakdown.

Forward Support Battalion (FSB) Training Team (GOLDMINERS).

Major - FSB S3 (Operations Officer) Trainer
Captain - Medical Company Trainer
Captain - Supply Company Trainer
Captain - Maintenance Company Trainer

Armor Task Force Training Team (COBRAS)

Captain - Maintenance Platoon Trainer
Captain - TF S4 (Supply Officer) Trainer

B. March 94 JRTC Field Trial O/C breakdown.

U.S. Army JRTC O/C's

Captain - Rifle Company O/C, Battalion TF 1
Captain - Rifle Company O/C, Battalion TF 2
Captain - Battalion C2 O/C, Battalion TF 3 (CPX)
Captain - Air Defense O/C, ADA Team
Captain - Medevac O/C, Aviation Team
SFC - Tank Platoon, Brigade C2 Team
SFC - Artillery Battery, Fire Support Team
SFC - FSB HQ, CSS Team
SFC - LLVI O/C, Intelligence Team
SFC - Foreign Internal Defense, Special Ops Det

U.S. Air Force O/C's (SINEX Project)

LTC - Air Force TACP O/C
Captain - Air Force TACP O/C
MSG - Air Force TACP O/C
BDM - SINEX Project contractor observer
PRC - SINEX Project test manager

C. March-May 94 NTC Field Trial O/C breakdown.

Note: Rank and position structure listed below represents one O/C Team. Forty participants were involved, twenty from the COBRA Team and twenty from the DRAGON Team.

COL/LTC - Senior Task Force Trainer
Major - Task Force XO Trainer
Major - Task Force S3 Trainer
Captain - TF TOC Trainer
Captain - S4 Trainer
Captain - S2 Trainer
Captain - HHC Trainer
Captain - Engineer Trainer
Captain - ADA Trainer
Captain - Scout Platoon Trainer
Captain - Medical Platoon Trainer
Captain - Maintenance Trainer
Captain - FSO Trainer
Captain - S1 Trainer
Captain - Armor Company Trainer
Captain - Armor Company Trainer
Captain - Mechanized Infantry Company Trainer
Captain - Mechanized Infantry Company Trainer
Captain - Company Trainer
SFC - Mortar Platoon Trainer

D. June 94 SINEX Field Trial O/C breakdown

Colonel - Air Force FAC
LTC - Air Force FAC
LTC - Air Force FAC
Major - Air Force FAC
Major - Air Force FAC
Captain - Air Force FAC
Captain - Air Force FAC

APPENDIX B:
O/C INPUT
AUGUST 93 FIELD TRIAL

APPENDIX B: (O/C INPUT AUGUST 93 FIELD TRIAL)

A. July coordination visit O/C concerns.

1). The ACCESS should have the capability to scan entire manuals and search by key word for references in such manuals.

2) The ACCESS should contain a reference library of FM and ARTEP manuals and a data base to draw from.

3) The ACCESS should have the capability to "cut and paste", between checklists, reference library, and the Take Home Package.

4) The ACCESS should have an enhanced Windows capability to ease movement between functions and programs.

5) The ACCESS should contain a graphics and spread sheet capability, to allow the creation of charts and graphs.

6) The ACCESS should have a cumulative report capability, to roll up checklists and statistics covering several days.

7) The ACCESS should be capable of producing reports on an "as needed" basis using a flexible, easy to use report generator.

B. Mid-rotation interview O/C concerns.

1) Reports which track statistics do not update based on new input.

2) At least two computers automatically shutdown when the temperature raised above 90 degrees.

3) The computer screen, light background with dark characters, could not be adjusted to ease viewing during the days, and produced a bright signature at night.

4) Computer size hindered the O/C's ability to operate from his position in the vehicle.

5) Problems with the movement between different forms and checklists through multiple windows, as well as no ability to "cut and paste".

6) Problems with downloading collected information onto a diskette or the O/C Teams officer computers.

7) The need for each O/C to easily develop and refine their forms and checklists instead of having to utilize only those forms and checklists already loaded into their computers.

C. August field trial O/C after action review (verbal).

1) ACCESS needs to have a graphics capability to allow for the constructions of graphs and charts.

2) The ACCESS had problems downloading information to diskettes or other computers.

3) Difficulty locating one days specific data because of the Access automatic cataloging by number set, requiring the O/C to remember the report sequence to select a specific data set.

4) Movement within a checklist was limited, the user could only move forward in the checklist or form and was required to cycle through the whole document to get back to the same page.

5) The ACCESS should be enhanced to provide the user the ability to query the reports program for specific information, instead of being restricted to just the items produced by the report generator.

6) Too many steps were required to open checklists and forms, the process should require only one or two steps.

7) The THP requires a full word processing program and capability; the ACCESS did not provide cut and paste, spell check, and word wrap.

8) The laptop, with its accessories (battery recharger, power cables) required space that caused the O/C difficulties while operating the system from the driver's seat of the HMMWV.

APPENDIX C:
AUGUST 93 FIELD TRIAL O/C
AAR QUESTIONNAIRE

APPENDIX C: (AUGUST 93 FIELD TRIAL O/C AAR QUESTIONNAIRE)

This appendix outlines the questionnaire utilized to gather O/C input following the August 93 field trial. Under each question the verbatim comments from the O/C's are posted. When an O/C provided no comments, a notation is made within brackets. Any issue which refers to a comment made by an O/C is contained in brackets.

I. PRE-ROTATION TRAINING/USE.

A. How long did you spend planning and preparing for observations you would make or information you would collect in the field?

1. FSB S3 Trainer: 4 hours.

2. Medical Company Trainer: 3 hours.

3. Maintenance Company Trainer: 5 hours.

4. Maintenance Platoon Trainer: 104 hours.

5. TF S4 Trainer: 1 hours, 15 minutes.

6. Supply Company Trainer: 3 hours.

B. What written materials, if any, did you prepare? (Mark all that apply?)

1. FSB S3 Trainer: Notes of key points to observe, Structured data collection forms (checklists, etc.), Task lists (for example, drawn from MTP), Doctrinal guidance (for example, from FM's).

2. Medical Company Trainer: Task list (for example, drawn from MTP), and Other: The data stored on this computer was used during "backbrief" on my units chain of command after battles.

3. Maintenance Company Trainer: Notes of key points to observe, Structured data collection forms (checklists, etc.).

4. Maintenance Platoon Trainer: Notes of key points to observe, Structured data collection forms (checklists, etc.), Task lists (for example, drawn from MTP), Doctrinal guidance (for example, from FM's), and Other: THP, Charts for AAR's.

5. TF S4 Trainer: Structured data collection forms (checklists, etc.), Task lists (for example, drawn from MTP), Doctrinal guidance (for example, from FM's).

6. Supply Company Trainer: Notes of key points to observe, Task lists (for example, drawn from MTP).

C. Did you use the ACCESS system in preparing for the rotation?

1. FSB S3 Trainer: Yes. Reviewing checklists.

2. Medical Company Trainer: No. The checklist stored is available in hard copy.

3. Maintenance Company Trainer: Yes. Went through checklist to refresh memory on specific areas to check and criteria for those areas.

4. Maintenance Platoon Trainer: No. The data was not available before the rotation.

5. TF S4 Trainer: Yes. The Counter-part (S-4) interview sheet.

6. Supply Company Trainer: No. Was not familiar enough with the system to spend the time necessary to learn and prepare simultaneously.

D. How much time, if any, did using the ACCESS system save you in preparing to go to the field?

1. FSB S3 Trainer: 2 hours.

2. Medical Company Trainer: 0 hours.

3. Maintenance Company Trainer: 2 hours, 30 minutes.

4. Maintenance Platoon Trainer: 0 hours.

5. TF S4 Trainer: 30 minutes.

6. Supply Company Trainer: [Provided no comments.]

E. Were the data collection forms entered into your ACCESS before the rotation the ones that you expected to use?

1. FSB S3 Trainer: Expected more capability to collect data on CL III (Fuel), CL I (Food), and chart to analyze the data collected (i.e. spread sheet that can then be developed into a chart.

2. Medical Company Trainer: Yes.

3. Maintenance Company Trainer: Yes. However, the forms (maintenance) are repetitive. They ask for the same data in different format. All that is required to really track maintenance is a DA Form 2406. The system however must have the capability of compiling the data into different formats. Recommend a D-base type program where data can be extrapolated by requesting specific parameters.

4. Maintenance Platoon Trainer: Yes.

5. TF S4 Trainer: Yes - although I expected them to be more accessible from within the different programs/checklists.

6. Supply Company Trainer: No.

F. Did the training conducted prior to the rotation provide you with the necessary information you needed to know to use the ACCESS? (If not, what other areas of training are required?)

1. FSB S3 Trainer: Yes.

2. Medical Company Trainer: Yes. Thorough briefing was presented.

3. Maintenance Company Trainer: Yes. I needed more instruction on how to specifically work my maintenance charts and how these charts worked with each other. I was unclear on how data tied in once it was imputed.

4. Maintenance Platoon Trainer: Yes.

5. TF S4 Trainer: Yes - it was more than sufficient.

6. Supply Company Trainer: How to download the information to the disk and print on the Mac computer.

G. What else would have been helpful to have had entered into the system before you deployed to the field?

1. FSB S3 Trainer: FSB MTP or ARTEP instead of maneuver units ARTEP.

2. Medical Company Trainer: All requested was available in THP format and checklist for doctrinal review.

3. Maintenance Company Trainer: Split screen capability. Ability to have various windows, files, and graphs availability while working in the THP portion.

4. Maintenance Platoon Trainer: ULLS Information, i.e. PLL and ASL available.

5. TF S4 Trainer: More doctrinal manuals for reference material.

6. Supply Company Trainer: Charts/forms or spreadsheet that are compatible with Mac programs.

II. DURING THE ROTATION.

A. Did you routinely use the ACCESS to collect data in the field?

1. FSB S3 Trainer: Yes. Primarily to review checklists and prepare comments.

2. Medical Company Trainer: No. I found it difficult to set-up and utilize in a timely manner as my unit maneuvered. Use at night is very awkward.

3. Maintenance Company Trainer: No. System had data preloaded which invalidate all the data I was inputting. Also had problems extracting data downloaded to a floppy.

4. Maintenance Platoon Trainer: No. The forms take to long and the reports do not generate the required information, especially hard copy.

5. TF S4 Trainer: Yes. Though, after the first mission, I realized it was more time consuming and awkward to use during the execution of the mission. I recorded a few observations.

6. Supply Company Trainer: No. Needed charts that support the data.

B. What other methods did you use to record your observations and collect information in the field? (Mark all that apply.)

1. FSB S3 Trainer: 3 x 5 cards.

2. Medical Company Trainer: 3 x 5 cards, Notebook, Hard copy checklists or other pre-structured forms, Other: Voice activated recorded.

3. Maintenance Company Trainer: 3 x 5 cards, Hard copy checklists or other pre-structured forms, Other: Brigade 2406, Unit 2406, Unit CL IX requisition

4. Maintenance Platoon Trainer: 3 x 5 cards, Notebook, Hard copy checklists or other pre-structured forms.

5. TF S4 Trainer: Notebook.

6. Supply Company Trainer: 3 x 5 cards.

C. How much time did you spend during the rotation preparing notes and completing written materials:

1. FSB S3 Trainer:

   a. Using ACCESS: 4 hours.
   b. Using other methods: 28 hours.

2. Medical Company Trainer:

   a. Using ACCESS: 1 hours.
   b. Using other methods: 6 hours.

3. Maintenance Company Trainer:

   a. Using ACCESS: 0 hours.
   b. Using other methods: 5-6 hours per day.

4. Maintenance Platoon Trainer:

   a. Using ACCESS: 24 hours.
   b. Using other methods: 100 hours.

5. TF S4 Trainer:

   a. Using ACCESS: 15 hours.
   b. Using other methods: 6 hours.

6. Supply Company Trainer:

   a. Using ACCESS: 3 hours.
   b. Using other methods: 4 hours.

D. How much time do you estimate that the ACCESS saved you compared to your usual methods for preparing notes and completing written materials?

1. FSB S3 Trainer: No time while in the field. Stopped using after I found out that I could not get data out of the system.

2. Medical Company Trainer: 0 hours.

3. Maintenance Company Trainer: 0 hours.

4. Maintenance Platoon Trainer: 0 hours.

5. TF S4 Trainer: 0 hours.

6. Supply Company Trainer: Cost me 3 hours.

E. What type of AAR's did you make inputs to during this rotation?

1. FSB S3 Trainer: All CSS AAR's.

2. Medical Company Trainer: Platoon, Company, FSB Battalion AAR's, and TF CSS AAR's.

3. Maintenance Company Trainer: BRONCO, TARANTULA, and SCORPION Team AAR's.

4. Maintenance Platoon Trainer: The TF AAR, TF CSS AAR, the Maintenance AAR, and the FSB AAR.

5. TF S4 Trainer: The data I collected was used in the TF and CSS instrumented AAR's. Also, on a daily basis, I gave HUMMV-top AAR's to the S4.

6. Supply Company Trainer: FSB/CSS AAR's, COG final AAR.

F. Did you use the ECI for any of your AAR's? (If so, describe what was used and how you used it.)

1. FSB S3 Trainer: Used notes made on THP as reference for AAR's.

2. Medical Company Trainer: No.

3. Maintenance Company Trainer: No. System was nonoperational. [NOTE: Referencing the TUSK which went in-op after half the rotation, and SHARP laptop which was swapped for TUSK had download problems.]

4. Maintenance Platoon Trainer: No.

5. TF S4 Trainer: Yes, during the first mission. I showed the S4 my observations as the basis of the AAR.

6. Supply Company Trainer: No.

G. How much time do you estimate that the ACCESS saved you compared to your usual methods for data collection?

1. FSB S3 Trainer: 0 hours.

2. Medical Company Trainer: 0 hours.

3. Maintenance Company Trainer: [Provided no comments.]

4. Maintenance Platoon Trainer: 0 hours.

5. TF S4 Trainer: 0 hours.

6. Supply Company Trainer: [Provided no comments.]

H. If ACCESS did not save you time, what was the reason?

1. FSB S3 Trainer: See comments in "D" above.

2. Medical Company Trainer: Could not produce a written product, very awkward to use in a timely manner (set-up on the fly).

3. Maintenance Company Trainer: Unable to use maintenance ACCESS due to pre-loaded data. Spent 6-8 hours attempting to download THP data onto floppy.

4. Maintenance Platoon Trainer: See my comments on 2A.

5. TF S4 Trainer: Inaccessibility to the system while moving/idling. Additionally, there was no safe/reasonable way to secure the equipment to prevent damage. [NOTE: Referencing the equipment set-up for use and not in carrying case.]

6. Supply Company Trainer: Cost me 3 hours. Input data I could not extract; therefore, I had to put the data on another system.

I. In general, how comfortable were you in using the ACCESS computer as a tool in the field? (Circle one and explain.)

1. FSB S3 Trainer: Very comfortable. Right idea - just needs some more work.

2. Medical Company Trainer: Not comfortable. All reasons I noted above.

3. Maintenance Company Trainer: Moderately comfortable. Needed more instruction on how all the maintenance data ties in, and how all the data affects compiled reports.

4. Maintenance Platoon Trainer: Moderately comfortable. The computer aid idea was fine. The output was not useful in its present state.

5. TF S4 Trainer: Not comfortable. Because I could not readily use all of the programs. Rather, I had to quit one to open the second.

6. Supply Company Trainer: Moderately comfortable. System was easy to set up and use.

J. Overall, how useful was the ACCESS to you in the field?

1. FSB S3 Trainer: Not useful. See comments in "D" above.

2. Medical Company Trainer: Not useful. All reasons noted above.

3. Maintenance Company Trainer: Not useful. Could not download data.

4. Maintenance Platoon Trainer: Not useful. The requirement for hard copy data and the length of time required to use input data.

5. TF S4 Trainer: Moderately useful. The take-home package was formatted for easy use. However, I could not access the daily summary or the COBRA 08 list as reference.

6. Supply Company Trainer: Not useful. Problems getting information out of the system (downloading).

K. What impact did using the ACCESS have on the accuracy of the data you collected?

1. FSB S3 Trainer: No impact. Accuracy depends on unit giving the data, not the machine.

2. Medical Company Trainer: No impact. Did not use enough to have an impact.

3. Maintenance Company Trainer: No impact. Not used.

4. Maintenance Platoon Trainer: No impact. Because it is too time consuming to keep up with.

5. TF S4 Trainer: No impact. I had to rely on my rotation notebook, as usual, for my information.

6. Supply Company Trainer: No impact. It is just another means to collect and store the data.

III. AFTER THE ROTATION.

A. How long do you expect to spend after this rotation preparing your inputs to the Take Home Package?

1. FSB S3 Trainer: 6 hours.

2. Medical Company Trainer: 6 hours.

3. Maintenance Company Trainer: 4 hours, 30 minutes.

4. Maintenance Platoon Trainer: 6 hours.

5. TF S4 Trainer: 3 hours.

6. Supply Company Trainer: 5 hours.

B. How much time do you estimate that using the ACCESS system for preparing the THP inputs will save you?

1. FSB S3 Trainer: Questionable.

2. Medical Company Trainer: 0 hours.

3. Maintenance Company Trainer: If laptop worked as required, it would save 2 hours.

4. Maintenance Platoon Trainer: 0 hours.

5. TF S4 Trainer: [Provided no comments.]

6. Supply Company Trainer: 3 hours.

C. What days and types of missions did you use ACCESS for?

1. MAJ FSB S3 Trainer: Could save many hours with the ability to input from the field - end of rotation could be reduced to only Executive Summary.

2. Medical Company Trainer: Attempted for the Deliberate Attack (Day 3) and Hasty Attack (Day 9).

3. Maintenance Company Trainer: On the maintenance side, the ACCESS would have been used every day.

4. Maintenance Platoon Trainer: [Provided no comments.]

5. TF S4 Trainer: 9 Aug - 14 Aug: Movement to contact, defense in sector, and deliberate attack.

6. Supply Company Trainer: Movement to contact, hasty attack, defense in sector, up through Training Day 6.

D. What hardware problems did you experience (i.e. screen difficult to read in the day, light signature at night, etc.)

1. FSB S3 Trainer: Yes. Very hard to read in direct sunlight. To much light at night.

2. Medical Company Trainer: Couldn't read during day and blinded at night.

3. Maintenance Company Trainer: Battery power stinks, less than 30 minutes.

4. Maintenance Platoon Trainer: Screen to bright at night. The computer takes to long to set up.

5. TF S4 Trainer: Can't read screen at midday, light signature at night, power drain on HUMMV batteries, floppy drive failure, no way to use it while on the

move or at short halts, too many cables to organize, cumbersome carrying case, soft power connector to HMMWV, and no carrying handle on the laptop itself.

6. Supply Company Trainer: Screen difficult to read in day.

E. Did you back-up the ACCESS data by other methods?

1. MAJ FSB S3 Trainer: 3 x 5 cards.

2. Medical Company Trainer: 3 x 5 cards, Notebook, Hard copy checklists or other pre-structured forms, Other: Voice activated recorded.

3. Maintenance Company Trainer: 3 x 5 cards, Notebook, Hard copy checklists or other pre-structured forms.

4. Maintenance Platoon Trainer: 3 x 5 cards, Notebook, Hard copy checklists or other pre-structured forms.

5. TF S4 Trainer: Notebook.

6. Supply Company Trainer: 3 x 5 cards.

F. Did you need help using the ACCESS during the rotation? (If so, where and how did you get the help?)

1. FSB S3 Trainer: N/A

2. Medical Company Trainer: Fellow testers.

3. Maintenance Company Trainer: Yes, having data deleted from the system. [NOTE: no assistance available.]

4. Maintenance Platoon Trainer: No.

5. TF S4 Trainer: No.

6. Supply Company Trainer: Yes, came to the LYNX building.

G. How frequently did you consolidate your data and review it in the Reports portion of the ACCESS? Did the Consolidated Reports program provide you with what you needed?

1. FSB S3 Trainer: Daily.

2. Medical Company Trainer: Couldn't store structured data, not computer literate enough.

3. Maintenance Company Trainer: N/A.

4. Maintenance Platoon Trainer: The reports did not provide the information I needed.

5. TF S4 Trainer: After every mission THP was completed. Consolidated Reports provided what I needed, but the listing needs simplification.

6. Supply Company Trainer: Up to Training Day 6.

H. Did you review the ARTEP in the software? Do you have comments or suggestions as to how Army publications (such as the ARTEP) could be of use during the rotation?

1. MAJ FSB S3 Trainer: Wrong ARTEP.

2. Medical Company Trainer: MTP (ARTEP) are key tools for the O/C, as they lay out specific details required.

3. Maintenance Company Trainer: Should be broken into categories as opposed to individual items. Examples:

   a. Category 1: Conduct Tactical Road March
      (1) Plan Co move
      (2) Conduct recon
      (3) Organize convoy

4. Maintenance Platoon Trainer: Yes. Need a split screen.

5. TF S4 Trainer: Yes. Must have the ability to organize MTP's by task #, Plan-Prep-Execute, critical tasks, leader tasks, or battle tasks. Also, need to be able to tag tasks as unit METL.

6. Supply Company Trainer: No.

I. Were you able to download data to another computer after the rotation? (If there were problems, identify them.)

1. FSB S3 Trainer: No - could not get reports to function properly.

2. Medical Company Trainer: Heck no - would have to be loaded through this task.

3. Maintenance Company Trainer: No. System goes through whole motion of saving items but nothing got put on a disk. Unable to download to a desktop system. Unable to download directly to a printer.

4. Maintenance Platoon Trainer: N/A.

5. TF S4 Trainer: Yes.

6. Supply Company Trainer: No, would not transfer to Mac.

J. What is your overall impression of the utility of the ACCESS for O/C's here at the NTC?

1. FSB S3 Trainer: Right idea - needs work.

2. Medical Company Trainer: If shortcomings are addressed, it could be a useful tool.

3. Maintenance Company Trainer: Great, despite problems.

4. Maintenance Platoon Trainer: Could be extremely useful with modifications.

5. TF S4 Trainer: Currently, ACCESS has a 40% solution. Good idea but requiring O/C's to additionally input data beyond their notes.

6. Supply Company Trainer: Could be helpful, must be transferable to Mac.

K. What improvements do you feel could be made to the ACCESS which would contribute to your efficiency and effectiveness as an O/C?

1. FSB S3 Trainer: [Provided no comments.]

2. Medical Company Trainer: Word processing capability. Could have loaded all previous THP's, for references to similar situations.

3. Maintenance Company Trainer: Need graphics capability. Need ability to save files under names I choose. System doesn't tell you what it is saving the file as. Why can't files be saved directly to a disk?

4. Maintenance Platoon Trainer: The reports need to change in how the data is read to the reports. I have to have a printer.

5. TF S4 Trainer: Multi-window capability; editor in WP format; download in whatever WP the CALL or ARI are using; save to disk in any window.

6. Supply Company Trainer: [Provided no comments.]

L. Any other comments on the ACCESS?

1. FSB S3 Trainer: [Provided no comments.]

2. Medical Company Trainer: Good box, endured the rotation. [NOTE: Referencing the carrying case.]

3. Maintenance Company Trainer: [Provided no comments.]

4. Maintenance Platoon Trainer: [Provided no comments.]

5. TF S4 Trainer: [Provided no comments.]

6. Supply Company Trainer: [Provided no comments.]

APPENDIX D:
ECI FIELD
DEMONSTRATION RESULTS

JOINT READINESS TRAINING CENTER

ECI FIELD DEMONSTRATION RESULTS

MAY 1994

BDM Management Services Company
P. O. Box 3914
Fort Polk, Louisiana 71459

TABLE OF CONTENTS

LIST OF TABLES

FOREWARD

Questions pertaining to ECI evaluation methodology or enclosed results, and requests for reprints should be directed to: Commander, Operations Group; Joint Readiness Training Center; Attn. ATZL-JRO-Y (Maj. Hedrick); Fort Polk, Louisiana 71459. BDM Management Services Company point of contact is Mary R. Campbell.

Questions regarding ECI equipment should be directed to Mr. Mike McClusky; Unit Performance Measurement and Database Team Leader; U. S. Army Research Institite; P. O. Box 5787; Presidio of Monterey, California 93944.

JRTC ECI FIELD DEMONSTRATION RESULTS

INTRODUCTION

A field evaluation for the acceptability of an Electronic Collection Instrument (ECI) was conducted in March 1994 at the Joint Readiness Training Center (JRTC). Observer/Controllers (O/Cs) used prototype hardware and software in the field during the course of a single training rotation, 94-5. An empirical data collection effort was conducted to determine what the O/Cs' information needs are, and how well the fielded system met those needs. This report presents the results of the field evaluation. It begins with a description of JRTC O/C demographics to include their experience with, and attitude towards, computer technology. The O/Cs' information needs are defined in the next two sections which cover the kinds of information O/Cs wish to track (*Information Requirements*), and the means by which they wish to track information in the field (*MMI Hardware, and Software Requirements*). Finally, a comparison of the ECI fielded during rotation 94-5 is made with the system the O/Cs have said they would like to have.

METHOD

ECI Hardware

The computers taken to the field in 94-5 were *Dauphin* DTR-1 486SLC 25 MHz subnotebook computers equipped with 4 MB of RAM, a 60 MB hard disk drive, a backlit 640 x 480 VGA display, a tethered stylus, and a detachable keyboard. O/Cs were provided an extra battery, a 12 vdc cigarette lighter battery charger and adapter, and an aluminum foam-lined carrying case (about the size of a briefcase) to transport and protect the electronic equipment. Evaluation participants' HMMWVs were modified prior to the rotation by adding cigarette lighter wells, inline fuse holders, and 2.5 amp fuses to be used for battery recharging in the field.

ECI Software

Microsoft Windows (version 3.1 for the pen) was the only COTS software application loaded on the computers prior to ECI training immediately preceeding rotation 94-5. The handwriting recognition application and the basic word processor were disabled, as were several other

applications considered non-essential to the field test. Other software available on the computers taken to the field included *Form-Builder*, and *Form-Player* software applications which allowed O/Cs to create and complete their own individual data collection forms. JRTC MTP-based greenbooks were loaded on each computer to facilitate completion of these data collection instruments on a near real time basis during the rotation. Finally, selected ARTEP documentation was loaded for reference use.

O/C Participants

Demographic survey forms were distributed to ten O/C Divisions. One participant and one alternate was identified from each Division based on survey responses. The resulting group of participants was comprised of roughly equal numbers of officers and NCOs, a good range of educational backgrounds, various levels of computer expertise, and differing attitudes toward computers (individuals expressing both positive and negative attitudes were included).

Training

O/C participants received training on the basic ECI hardware configuration (including battery recharging), basic operation of the *Windows* operating system, an introduction to the *Forms-Builder* and *Forms-Player* software applications; the O/Cs were trained to enter their greenbook data. A total of 14 O/Cs participated in one of three training sessions conducted prior to the start of the rotation (from D - 9 to D - 7). Training sessions ranged from one to two days in length (a copy of the training roster appears in Appendix A). ECI equipment was signed out on hand receipt to each of 10 participants on D - 6. This gave some of the O/Cs the opportunity to continue to familiarize themselves with the equipment prior to the start of the rotation. A few were able to construct data collection forms they wished to use in the field.

Data Collection

Information was provided by O/Cs in the following five forms. First, *Demographic Data Surveys* were administered to approximately 10 O/Cs per 10 O/C Divisions about one month prior to the ECI field demonstration. Second, *Training Feedback Questionnaires* were administered to the 14 O/Cs who participated in the formal training sessions. Third, *Problem Report Forms* were given to each of 12 O/Cs, at the end of training, who actually used the ECI equipment in the field.

These booklets contained series of blank forms in which to record significant delays or loss of data experienced while using the ECI in the field. Fourth, *Man-Machine- Interface (MMI) Batteries* were administered to the 12 final participants: once at mid-rotation, and again at the end of the training exercise (ENDEX). The *MMI Battery* consisted of two questionnaires: one collected data on the physical conditions to which the ECI equipment was exposed, and the second collected feedback on the specific information each O/C entered into his computer. Finally, structured interviews were conducted with each O/C following completion of the *MMI Battery*. Participants were asked: 1) would they use the ECI, in its present configuration, in the field--specifying why, or why not; 2) if modifications could be made, would they use the ECI in the field--specifying what changes would be needed; and 3) how they would see the ECI implemented in their O/C Division in the event equipment was purchased. An ECI evaluation debriefing was conducted during the interview which followed the final iteration of the *MMI Battery*.

RESULTS

Results of the ECI field evaluation will be presented in four sections. First, a demographic description of the sample JRTC O/C population is presented. Next, data collection and analysis requirements specified by O/Cs during the course of the ECI evaluation is presented with a focus on software issues. Then a description of MMI requirements is presented focusing on hardware issues. Finally, an indication of how well the ECI equipment fielded during rotation 94-5 met both O/C information and MMI requirements will be presented.

JRTC O/C Demographics

Demographic data was collected from 122 O/Cs representing 10 O/C Divisions (listed below in Table 1) to facilitate selection of the 12 final ECI participants which was based on demographic data such as attitude toward, and experience with computers. Analysis of the full sample of 122,

Table 1. O/C Divisions Represented in ECI Field Demonstration

Bde C2 / Armor	Task Force 1	Task Force 2	Task Force 3 (CPX)
Intelligence	Fire Support	CSS	ADA
Special Ops	Aviation		

which comprises approximately 20-25% of the JRTC O/C population, will be presented in this section [1].

The average age of the 122 demographic survey respondents is 34 with an observed range from 31 to 50 years. The average amount of JRTC field experience reported by the O/Cs is 13 months with a range from 0 to 52 months. The amount of O/C experience reported is broken out into six-month intervals in Table 2. Examination of this data reveals that nearly one-third of all O/Cs (in the sample) have between 6 and 12 months experience. One-fourth of all O/Cs report less than 6 months experience; however, this group is balanced by a group, nearly as large, who report up to two years' experience in the field at the JRTC.

Table 2. Amount of Field Experience per Six-month Interval

Field Experience	*O/Cs*
Up to 6 months	25%
6-12 months	31%
12-18 months	14%
18-24 months	21%
24 months or greater	9%

Only 21 out of the 122 respondents reported having experience working in the TAFF (Training and Feedback Facility) which would include exposure to the JRTC's data collection and analysis system (the Interim Instrumentation System, or IIS). An average of 8 months experience was reported by this group with a range from 1 to 36 months.

A total of 49 officers and 73 NCOs comprised the group of 122 demographic survey respondents. The distribution of ranks is presented in Table 3 as the number of O/C respondents in each rank divided by the total number of respondents (122). The officers make up 40% of the sample population, and the NCOs comprise 60% of the group.

Education closely follows the rank structure, as would be expected. The highest level of education attained by officers and NCOs is presented as a percentage of the total sample in Table 4 below.

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[1] *The demographics of the subsample of 12 final ECI participants has been found to be representative of the larger sample of 122.*

Table 3. Representation of Ranks in Demographic Sample

Officer Ranks	
Rank	% of Total
O-3	34%
O-4	4%
O-5	2%
Total	40%

NCO Ranks	
Rank	% of Total
E-6	15%
E-7	42%
E-8	2%
E-9	1%
Total	60%

Table 4. Education Level by Rank

Highest Level of Education Attained	*Percent of Total Sample*		
	Officers	NCOs	*Total*
H.S. diploma or G.E.D.	0	7%	7%
Some College	0	34%	34%
Assoc. or Vo-Tech degree	0	16%	16%
Four year degree	34%	3%	37%
Graduate degree	6%	0	6%
Total	40%	60%	100%

The demographic information of paramount importance to the ECI evaluation is the O/Cs' experience with and attitude toward computers. Amount of computer experience was measured by asking O/Cs to report their level of experience with the computer operations and three types of software applications: word processing software, data analysis or database software, and graphics applications. Responses were made for each of the above four categories in multiple choice format with four options (one of which was always "no experience"). The amount of computer experience, expressed as the percent of responses made in each category, are presented in Appendix B.

Focusing on the percentage of "no experience" responses in each category provides an idea of the relative level of expertise attained in each. Not surprisingly, O/Cs indicated greatest familiarity with word processing software applications. Only 14% indicated they had no experience at all; half reported some experience, and an additional 36% reported extensive experience. O/Cs

reported the least amount of experience using data analysis, or database software: 41% responded as having no experience at all, and most of those with experience reported only basic exposure. This means that, as a group, O/Cs do not have a good concept of how to build a database of performance measures for later use in AAR preparation, THP production, or trend analysis. Graphics applications experience was also comparatively weak; 29% of all respondents reported no experience; only 17% of all O/Cs indicated they had experience beyond the creation of text slides. This means most O/Cs do not currently possess the necessary skills to produce operational graphics or an objective sketch on a computer. The majority of the O/Cs (64%) indicated they have at least a basic level understanding of PC operations; however, 19% reported no experience, and only 17% have more than a basic level understanding of *PC operations*. It is reasonble to extrapolate from these findings that most O/Cs probably have no understanding of less common computer operations such as networks, data transmission, uploading and downloading of data files, etc.

Attitude toward computers was measured using a single multiple-choice question which contained a five-point rating scale ranging from unfavorable (1) to very favorable (5). Only 4% of O/C survey respondents expressed a strong negative opinion; 15% said they would learn more about computers if they needed to. The majority of respondents (57%) indicated a "definite interest in computers;" an additional 24% expressed even greater interest. The overall attitude expressed in the demographic surveys was more positive than expected; additional evidence of the O/Cs' positive attitude was observed in the conduct of the 12 ECI evaluation participants during rotation 94-5 (see transcript of MMI interviews in Appendix C).

CORRELATIONS BETWEEN DEMOGRAPHIC VARIABLES

Correlations between the demographic variables were computed in an attempt to identify potential determinants of the O/Cs' positive, or negative, attitudes toward working with computers. Computer attitude scores were correlated with: *education level*, *O/C age*, *computer experience*, and *field experience* [1]. Only previous computer experience was found to have a strong (i.e. statistically significant) relationship with computer attitude. O/Cs with the most computer experience expressed the most favorable attitudes towards computers (average computer attitude

[1] *In each case Pearson's product-moment correlations with two-tailed probabilities were computed.*

scores are presented by computer experience levels in Table 5). In this case, familiarity with the subject seems to have improved attitudes toward computers.

Since previous experience working with computers was found to coincide with a positive attitude toward computers, potential correlates of computer experience were sought. *O/C age* was

Table 5. Computer Attitude by Computer Experience Level [1]

Computer Experience Level [2]	*Number of Respondents*	*Avg. Attitude Score* [3]
1: Not much experience	29	2.52
2: Basic level experience in most categories	67	2.97
3: Extensive experience in some categories	14	3.43
4: Extensive experience in most categories	7	4.14
Total # respondents/Group mean	117	2.98

[1] *Correlation coefficient = 0.52 which is statistically significant ($p<0.001$).*

[2] *Composite scores computed by summing experience level in each category and dividing by 4.*

[3] *Computer attitude expressed on a five-point scale: 1=unfavorable opinion; 5=very favorable opinion.*

found to be negatively correlated with computer experience; the younger O/Cs reported the most experience working with computers. Average computer experience scores are presented by age interval in Table 6. A strong positive correlation was observed between O/C *education level* and computer experience. O/Cs with the most education also reported the greatest amount of experience using computers (average computer experience is presented by education level in Table 7). This finding reflects the trend towards introducting computers into the classroom at all levels.

In summary, the best predictor of O/C attitude toward computers was found to be the amount of experience they reported having worked with computers. The O/Cs reporting the most computer experience were younger, more educated individuals. This finding makes sense since it can be presumed that the younger O/Cs received their education during a time period in which an influx of computers into secondary schools and institutes of higher education occurred. It is important to note that neither *O/C age* nor *education level* alone reliably predicted computer attitude scores. A sizeable number of the older O/Cs reported positive attitudes toward working

with computers; and, conversely, many of the younger, more educated O/Cs expressed negative attitudes toward computers.

Table 6. Computer Experience Scores by O/C Age [1]

Age Intervals	*Number of Respondents*	*Avg. Exper. Score* [2]
Up to 30 years	10	2.20
31 - 35 years	60	2.07
36 - 40 years	43	1.94
41 - 45 years	7	1.77
Over 45 years	1	1.00
Total # respondents/Group mean	121	2.01

[1] *Correlation coefficient = -0.18 which is statistically significant ($p<0.05$).*

[2] *Composite scores computed by summing experience level in each category and dividing by 4.*

Table 7. Computer Experience by Education Level [1]

Education Level (highest attained)	*Number of Respondents*	*Avg. Exper. Score* [2]
H.S/G.E.D	8	1.47
Some College	42	1.76
Two-year degree/Vo-Tech	20	2.13
Four-year degree	45	2.19
Graduate degree	7	2.54
Total # respondents/Group mean	122	2.01

[1] *Correlation coefficient = 0.40 which is statistically significant ($p<0.001$).*

[2] *Composite scores computed by summing experience level in each category and dividing by 4.*

DEMOGRAPHIC SURVEY CONCLUSIONS

The demographic data support the following conclusions. The O/Cs, with noted exceptions, tend to have a positive attitude toward using computer technology, in general. Furthermore, this positive outlook tends to improve with experience using computers. O/Cs have the most

experience using word processing software, and other text-based (as opposed to graphics, or analysis) applications. They have less understanding of how computer systems are configured and operate. This characterization of the O/Cs' outlook should prove useful to anyone building a computer-based information system for the JRTC O/Cs, and when reading the section of this report on how the O/Cs rated the system they took to the field in rotation 94-5.

Information Requirements

O/Cs have indicated the type of data they want to collect, and have recommended collection methods, and sample output products. Data presented in this section comes from three sources. First, projections for ECI use were collected in the *Training Feedback Surveys* completed at the end of the training sessions. Second, descriptions of how the ECI was actually used in the field were obtained through the MMI battery and acompanying interviews conducted at mid-rotation and at ENDEX. Finally, a gross level summary of the way O/Cs envision the ECI linking the field O/Cs to the larger database at the EMCC was obtained by summarizing all of the above data.

PROJECTIONS FOR ECI USE

At the end of training (prior to the start of the rotation) O/Cs made projections as to how they would use the ECI in the field and how much time they might save using it to perform certain data collection and analysis tasks. O/Cs identified sample text and graphic products they might prepare for After Action Reviews (AARs). The percentage of "yes" responses to each of four sample word processing, and six sample graphics products are presented in Table 8.

Table 8. Projected Field Data Collection Needs

Sample products	*Formal AARs*	*Field AARs*	*Other*
Graphics Products			
Graphics slides (in general)	46%	31%	--
Operational graphics	62%	38%	--
Objective sketches	23%	15%	--
Word Processing / Text Products			
Text slides	54%	23%	--
THP Preparation	--	--	85%
Administrative Uses	--	--	54%

O/Cs were clearly in favor of using the ECI to create their draft THP in the field; their responses also indicate they projected the ECI would be more useful for formal AARs (which are prepared in the TAFFs) than for field AARs.

Nearly half of the O/C respondents indicated they would save some time (average = 1.33 hours) preparing for the rotation by using the ECI . O/Cs predicted they would spend an average of 21.11 hours taking notes in the field and that the ECI might save some time (average = 7.38 hours) performing this function. The ECI was predicted to "somewhat increase" the accuracy of data collected in the field (average response = 3.85 on 5-point scale). O/Cs projected they would spend an average of 12.17 hours preparing their THP drafts in the field and that the ECI might save a little time (average = 2.33 hours) executing this task.

ECI USE IN THE FIELD

The O/Cs' opinions on the usefulness of the ECI changed somewhat during the course of the rotation in which they used the computer to assist them with some of their information needs. Feedback on using the ECI for greenbook data collection will be presented first, followed by use of the ARTEP, or doctrinal reference library; use of the ECI for THP preparation; and AAR preparation; creation and use of additional data collection forms; electronic notetaking; and an assessment of the impact of the ECI on the accuracy of data collected.

The primary use of the ECI was to collect greenbook data in the field. All participants completed at least a portion of their particular greenbook during the rotation. Overall, the O/Cs liked the idea of entering greenbook data by computer:

1) to make greenbook data available on a near real-time basis (i.e. in time for use in AAR, and THP preparation);
2) to allow O/Cs to edit the content of the books (adding or deleting questions prior to the rotation to adjust for mission differences);
3) to protect the greenbooks from bad weather (paper copies can be destroyed by rain and mud--ECI in rugged case inside HMMWV is impervious to most bad weather conditions);
4) to provide a method for recording evaluations over successive iterations of a given task (to document progress made during the course of a rotation).

There were, however, some specific problems encountered using the ECI for greenbook data entry, some of which could be addressed in hardware/software engineering.

1) each electronic greenbook should be comprised of no more than three files, one for each mission:

2) scrolling speed needs to be improved;

3) the paper greenbooks are easier to manage in the field (they weigh less, are more portable, and easier to secure than the ECI);

4) entering data into the paper greenbooks is much faster than using the ECI.

Some of the problems associated with an electronic means of greenbook data entry are echelon-, or duty position-specific. O/Cs at platoon/section level and below, many of whom are frequently on the move, require light- weight, very portable means of data entry. A paper greenbook can be transported via cargo pocket, prepared for data entry in a matter of seconds, and is not likely to present security problems. O/Cs at company/battery level, many of whom have greater access to their vehicles, can afford the extra weight, processing time, and, perhaps also, the additional security risk posed by a computer.

Only 17% of the O/Cs indicated they had need to use the ARTEP library during the rotation. However, this low number can be explained by the fact that no Light Infantry doctrine was included in the library at the time of the field test. O/Cs indicated that *if* the doctrinal references they needed were available they would find a great deal of use for them (e.g. pulling extracts for use in field AARs, and copying references into greenbooks, or THP drafts). O/Cs like the idea of being able to carry doctrinal references in a compact, modifiable, transmittable form which is also comparatively safe from inclement weather (inside a case in a HMMWV). They were especially interested in the ability to tailor their doctrinal library to fit not only their BOS, and echelon, but also to include the references they might need to fulfill mission-specific, or other individual information needs.

By the end of the rotation only one O/C had successfully built a form in which to enter THP data. However, nearly all O/Cs reported that they *would have* done so if time had allowed. One O/C was prepared to write his draft on the ECI but was "discouraged" from doing so after having experienced technical difficulties which resulted in a significant loss of greenbook data. Another O/C wanted to prepare his draft THP in the field but did not realize until too late that he was responsible for building the form in which to hold the data (the only word processing capability enabled for the field test). A disadvantage to writing THP drafts on the ECI, as opposed to the laptops currently in use, is the small ECI keyboard. However, the ECI method of data entry would facilitate data sharing both within, and between O/C Divisions.

At the end of training, O/Cs expressed interest in using the ECI in the field for AAR preparation. None of the O/Cs produced any actual AAR products during the rotation. The reason for this omission was stated to be lack of time to build the necessary data collection forms prior to departing for the field. Once the O/Cs got to the field, most reported they did not have time to construct the forms: a few who tried reported they were not able to complete the task due to a lapse in expertise. A projected strength of the ECI would be its ability to facilitate the creation of graphics products for vertical (e.g. TAFF), and lateral (e.g. between companies) transmission to support formal, battalion AARs. Currently, field O/Cs are tasked to provide numerous graphic depictions of 1) the player unit's concept of what the battlefield looks like, and 2) what the battlefield actually looks like, or the "ground truth." The sketches and maps are hand carried from the field to the rear (a trip which takes approximately one hour each way). This process is often repeated, sometimes more than once in a 24-hour period, for corrections and updates. A feature O/Cs say would be most useful to them would be a graphics software application containing a Fort Polk map and at least a drawing tool to facilitate the creation of operational graphics, objective, and other sketches, contact reports locations, and other graphics products. O/Cs predict limited utility of these graphics products for field AAR use--*maybe* at company level.

Most O/Cs (75%) said they could identify additional data collection forms (other than greenbooks and THPs) they would use in the field. Most additional forms would be used to support AARs, and for exercise control purposes. Samples data collection forms offered by O/Cs are presented by BOS in Table 9 below. One O/C was actually able to use the ECI for all his data

Table 9. Sample Data Collection Forms for Field Use

Battlefield Operating Systems	*Sample Data Collection Forms*
Fire Support	Ammunition data
	Personnel strength
Armor (Bde C2)	Manning roster
	Equipment list
Aviation	BTO
	BOS slides for Bn AAR
	Leadership slides for Bn AAR

collection needs over the course of the rotation. He built 11 unique data collection forms and attempted to complete them in the field. Hardware modifications would be required to support most of his data collection needs (i.e. would need to adapt the ECI for use in a helicopter). However, if the other O/Cs had used this feature, more uses would have been identified. It also would have been helpful for the O/Cs to have been able to confer with the other members of their Division, especially the Sr. O/C who drives the AAR process, well in advance of the rotation to identify data which might be collected in the field using the ECI.

Four O/Cs reported spending approximately 13 hours taking handwritten notes during the rotation. Two of these reported spending an extra 2 hours taking notes using ECI. The two O/Cs who used the electronic means of notetaking expressed different opinions of the value of using this method; one felt using the ECI saved two hours, the other felt the computer saved no time.

O/Cs reported the ECI had "no impact" on the accuracy of data collected during the rotation. This average rating is less optimistic than was observed at the end of training at which time O/Cs projected the ECI would "increase accuracy somewhat." Contrasting average accuracy ratings over three consecutive data collection periods reveals a steady decrease of a total of one point (on a five-point scale) over time. Average accuracy ratings are presented by rating period below in Table 10. These results indicate the O/Cs' opinion became less favorable with increased experience using the ECI. The interpretation of these results is difficult given the fact that only one O/C actually experienced a significant loss of data during the rotation. Evidently the lesser problems encountered such as difficulty building data collection forms, or perhaps the inability to see the end products being created might explain the decrease in confidence observed over time.

Table 10. Average Accuracy Ratings Over Time

Rating Period	*Average*	*N* [1]
End of Training	3.85	13
Mid-Rotation	3.33	6
ENDEX	2.70	10

1 = Number of Observations, or survey respondents

SUMMARY OF INFORMATION REQUIREMENTS

Information, or data collection requirements were found to differ somewhat by echelon. The following summary of how the O/Cs envision the ECI being used will be presented accordingly starting at platoon/section-level and moving up through company/battery-level to battalion-level (hereafter referred to as Plt, Co, and Bn levels). At the Plt level O/Cs predict the ECI would be used mostly as a data collection instrument to support higher echelon AARs and exercise control needs. Plt O/Cs could enter greenbook data, and collect other textual and graphic data defined by their Sr. Co, or Bn staff-level O/Cs. ECI output products useful at the Plt level would be limited to doctrinal references to support Plt field AARs. Plt O/Cs typically cannot compile greenbook data for use in their own AARs which take place at COM + 2 hours: sooner than data from the execution phase of a mission can be entered into the greenbook (in electronic *or* paper format).

The ECI appears to hold the greatest value for Co level O/Cs who could take maximum advantage of not only the data collection capability, but also the data sharing and analysis capabilities of a computer system expanded to include the field. Like their Plt level counterparts, Sr. Co O/Cs would enter greenbook and other data defined by their superiors into the ECI. Like the others, they would be able to download doctrinal references for use in their field AARs. In addition, Co level O/Cs would have enough time to analyze greenbook and other data in preparation for Co-level field AARs (which are typically scheduled for COM + 4.5 hours). Co level O/Cs predict they would do a lot of vertical, and lateral data swapping. For example, at the end of a rotational phase, a Co-level maneuver O/C would examine greenbook data from his three Plts, as well as his own greenbook to prepare for his field AAR. In addition, he would examine AAR products being created (in the TAFF) for the formal Bn AAR (which typically takes place at COM + 8 hours) for possible inclusion in his field AAR. Finally, he would exchange information with his sister Cos to provide background for his own AAR, and in preparation for providing input to the Sr. Bn O/C for his formal AAR.

It is certain that the Sr. Bn O/Cs and their staffs (both in the field and in the TAFFs) would benefit from data collected using the ECI whether they interfaced with the equipment directly, i.e. had their own computers, or indirectly through the TAFFs. Bn-level O/Cs already have access to a computer system which includes multimedia data collection and analysis capbilities. The most significant addition to this system the ECI could offer would be an increase in the speed with

which data was available for analysis. Sr. Bn O/Cs would have access to greenbook data at all echelons within their O/C Division in time to incorporate trends into the Bn AARs. Comparison of the BLUEFOR unit's perception of the enemy situation with an O/C report of the "ground truth" enemy situation could be conducted more rapidly, and graphically (if the software supports this function), with an ECI. Timely unit strength data would be available to Bn staffs for input to the daily 1600 hour briefing . It could also be used to support administrative needs such as the tracking of NODs usage within the Division.

The ECI would offer a means of exchanging information, at all echelons, between O/C Divisions. For example, maneuver elements could monitor aircraft schedules; armor units could monitor the movement of Class V or IX supplies across the battlefield, or check the deadline & maintenance schedules of the CSS Division. Some of this data swapping capability already exists in the computer systems fielded (IIS) and currently under design (IS); the ECI would simply increase the pool of useful data which *could be* collected by making more timely data available.

The availability of training data on a near-real time basis would benefit exercise maneuver control center (EMCC) staff outside the TAFFs, as well. The Plans-EMC Division (responsible for the daily 1600 hour briefing, and a variety of additional exercise control and administrative tasks) are linked to the same IS database used in the TAFFs. Many of their information needs overlap with those of the other O/C Divisions, such as the timely tracking of unit strengths, real world casualties, movement of different classes of supplies across the battlefield, etc.

Man-Machine-Interface Requirements

MMI hardware requirements were found to vary somewhat by echelon and O/C duty position. O/Cs at the different echelons have different responsibilities, work in somewhat different physical environments, and operate under different time constraints in terms of information processing needs. As the O/Cs go where their BLUEFOR counterparts go, O/Cs at platoon/section level tend to spend more time in the woods travelling on foot than do company/battery level O/Cs. Company level O/Cs also go to the woods, but they tend not to move as far away from their vehicles for as long a period of time as the the O/Cs at one echelon below. Company level O/Cs also tend to have greater information processing needs, for example, they conduct more analysis, provide more input to AARs, and write more reports (to include THPs). Two distinct sets of MMI hardware requirements are presented below for the platoon/section level, and company/battery level O/Cs

who, together, would comprise the primary ECI user group. MMI software requirements did not differ significantly between the two groups and are, therefore, presented as applies to the entire O/C population.

HARDWARE REQUIREMENTS

For platoon/section level O/Cs, or for any O/C who spends a lot of time on the move and away from a vehicle, a rugged, highly portable pen-based computer is desired. A computer about the size (9" x 5.5" x 1.25") and weight (5-7 lbs) of the ECI taken to the field in 94-5, without the keyboard, would work. However, the machine needs to be ruggedized, i.e. able to withstand pressure equivalent to the weight of two adults, and be able to tolerate a quantity of water equivalent to sitting under a poncho in the pouring rain. The battery life must be improved. Ideally, a battery would last the duration of a mission, or approximately 36 hours. Alternatively, the use of batteries readily available to the force, such as alkaline ("AA," "C," or "D" cell), or lithium batteries, would be an improvement. And it is imperative that the system include handwriting recognition software. Based on the O/Cs' information requirements, provided in the previous section, much of the data collected by O/Cs at this echelon could be menu driven (check lists, multiple choice questions, etc.). However, they would also be completing greenbooks which include comment fields, and possibly other forms which would require free form writing. Since they would not likely be executing tasks involving a great deal of writing, a handwriting recognition software application of average quality, available in today's market, may be good enough. It is also reasonable to expect some improvement in the quality of such software by the time an ECI is fielded at the JRTC.

O/Cs at higher echelons, who move less frequently and have greater access to a vehicle (mostly HMMWVs), have different MMI requirements. They would prefer greater capability and ease of use over portability. A more powerful machine (i.e. greater processing speed, sufficient RAM and storage space to accomodate software applications loaded, and slightly longer battery life), equipped with a larger keyboard, and a rugged case which could be attached to the vehicle to protect and secure the equipment is desired. O/Cs at this echelon say they would enter more data, to include writing THP drafts; would interface more with the IS, both transmitting and retrieving data; would do some data analysis, e.g. roll-ups of greenbook data; and would actually produce some AAR products for field AARs. In short, they would be using the ECI like a desktop

computer and, therefore, desire as many tools as possible to accomodate the functions they wish to perform. Additional weight and size needed to improve functionality would be considered a worthwhile tradeoff.

MMI requirements common to O/Cs at all echelons include the following. Many O/Cs find they have time to tend to their data collection, and analysis work at night when the BLUEFOR is less active. Computers with a backlit screen monitor can present problems in the field. O/Cs are very sensitive to violations of the BLUEFOR's light discipline which can make their positions known to the OPFOR. The machine fielded during rotation 94-5 created a light signature described as, "enormous," "too large," "too bright with a hat on it." One O/C team used the ECI as a flashnight at night. A minimum requirement for a backlit screen would be very low light operability. Other potential solutions would be the use of infrared screens, or switching to hardware/software which operates in alternate sense modalities such as a voice activated system. The feasability of offering two methods of interfacing with the ECI: one for daytime operations, and one for night operations, should be examined.

For those O/Cs who would use the keyboard method of data entry, the desired configuration is a keyboard which *attaches* to the CPU; if it also had the capability to be detached, so much the better. However, O/Cs clearly did not like being restricted to using the two pieces independently. This method of data entry was reported to be completely untenable. Those who used the pen method of data entry expressed interest in a more rugged stylus which could be *securely* attached to the CPU. Many O/Cs suggested replacing the pen with a trackball (mouselike method of data entry). Ancillary enhancements recommended were availability of a 3.5" floppy disk drive, and printing capability (not necessarily in the field).

All O/Cs expressed interest in defining a way to secure the equipment during field use. While this should not be difficult to do; it is an issue which *must* be addressed if and when ECI equipment is fielded at the JRTC. O/Cs are also interested in how the digital interface with the OCCS would be accomplished. Relevant questions include: would digital transmission of ECI data over the OCCS require use of individual O/C's radios? If so, what changes in the speed or quality of voice or data transmission would be experienced? And, if so, how easily could O/Cs switch from voice to digital mode, and back? In any case, additional training requirements for

using the ECI, to include data transmission (both ways), should be examined for complexity and time requirements.

SOFTWARE REQUIREMENTS

Software requirements are based on information requirements defined in the previous section, and on specific O/C feedback. An operating system with a graphical user interface, such as *Microsoft Windows* used during the field test, is desired. The O/Cs found this software easy to learn and easy to use. Using this type of software should reduce the amount of training required, and could provide maximum work efficiency for users, i.e. fewer interruptions to ask questions may be necessary, and fewer errors may be observed in work produced.

A software application to facilitate the entering of greenbook data is needed. The competing demands of executing a large scale data entry project on a small scale (subnotebook) computer will make the task of identifying a suitable program challenging. An additional challenge will be to find a program which would operate equally well during daytime and nightime operations (see above section on MMI Hardware issues). The greenbook data collection form is only one of many unique data collection forms O/Cs may wish to create to support AAR preparation, THP draft writing, exercise control, and administrative tasks from the field. A software application which will allow O/Cs to build new forms, and enter data into them is needed. A general purpose, very basic word processor is desired. This could be part of the form building software as long as it was easy to use, and had a seamless interface with word processing software (currently use *Enable*) available on PCs in the rear. The purpose for the smooth interface is to allow O/Cs to take up draft report writing (e.g. THP), or administrative work started in the field at the rotation's end when they leave the field and return to their offices. O/Cs have not suggested they require separate computers for the field and office. A more economical configuration may be to equip O/Cs with one computer which could serve both functions. O/Cs could take a bare bones system to the field (CPU with built in small screen monitor, and attached pen) leaving their keyboards, larger screen monitors and printers behind in the office for post-rotation use.

Handwriting recognition software must be available in order for the CPU/pen system, desired by the more mobile O/Cs at platoon/section level, to be feasible. It is also desired by other O/Cs to use at least part of the time they are in the field. Availability of this software would certainly

expand the number of uses O/Cs could find for ECI equipment in the field. Also, keyboard alternatives should be available for all pen-based commands to improve processing speed.

One of the critical functions desired by the O/Cs is a graphics application (see previous section on Information Requirements) which would include a Ft. Polk map and at least a drawing tool to facilitate the creation of operational graphics, objective, contact report, and other sketches for vertical (e.g., to the TAFF and back), and lateral transmission (e.g., exchanges between sister companies). The sophistication of this software does not have to match that of the hardware and software available to produce graphics in the TAFFs. The desired capability, which could be provided by the ECI, would be to dramatically increase the speed with which graphic depictions of field events could be generated and shared throughout the training center. Some O/Cs, especially at company level, would also use graphics software extensively for the production of slides to support field AARs. O/Cs at all levels would use this software to create slides for administrative purposes.

HOW TO FIELD ECI WITHIN O/C DIVISIONS

O/Cs were asked, during the course of the MMI interviews, how they would envision the ECI being distributed in their O/C Division. It is important to emphasize the following recommendations are based on one rotation's experience using the equipment. To summarize, the O/Cs were agreed that an electronic means of data collection would not be useful at echelons below platoon/section level. They differed in opinion on the utility of employing ECI computers at platoon/section level (complete transcripts of O/C opinion offered is presented by O/C Division at the end of Appendix D). Most felt O/Cs at this level have a significant data collection contribution to make. The point on which they differed is whether platoon O/Cs each need their own machines, or whether they simply need access to their Sr. Company O/C's computer to fulfill their data collection obligations. The consensus seems to be the latter option.

While O/Cs above company level were not represented in the field test (with the exception of providing demographic data), feedback provided by other O/Cs, and common sense, indicates O/Cs at this echelon may have little need for ECI equipment. Battalion level O/Cs already have access to the technology and staff (in the TAFFs) needed to produce a large variety of data output

products in multimedia format. They may prefer to continue to task their staffs to collect, analyze, and produce the various output products they need to support the numerous information demands made on them.

It seems logical that distribution decisions be made individually by O/C Divisions to ensure everyone who needs a computer receives one. However, if most Divisions follow the above logic in making their distribution decisions, the overall number of computers needed is far less than the total number of O/Cs employed at the JRTC.

Assessment of ECI Fielded in 94-5

The above sections have defined what information O/Cs wish to track (*Information Requirements*), and the means by which they wish to track information in the field (*MMI Hardware, and Software Requirements*). This section will compare the ECI fielded during rotation 94-5 with the system the O/Cs have said they would like to have.

TRAINING FEEDBACK

O/Cs indicated they would have preferred a longer training session (average amount of training received = 9.14 hours). They would add self-paced practical exercises throughout the training session, and at the end, to test mastery of various skills. They would also add an opportunity for unstructured one-on-one attention from trainers, near the end of the training period, to answer unresolved questions. O/Cs wanted handouts to use during training, and later when on their own in the field, which contained an overview of the hardware and software, as well as very basic operating instructions: a simple list of functions, for example. O/Cs would have preferred to have been trained on the hardware *and* software subsequently taken to the field to include copies of the O/C's particular greenbook, selected reference materials, a THP outline, and other operator (O/C) designed forms and report formats.

At the end of training O/Cs indicated they were not fully prepared to use the ECI equipment (average response on a 5-point preparedness scale covering six software features was 3.76 which falls between "neutral" and "prepared"). They said they generally understood the system, but felt they lacked enough time to work with the ECI on their own prior to the rotation. O/Cs indicated they were best prepared (average rating = 4.30) to enter greenbook data (although 29% of the O/Cs had yet to see a greenbook loaded on the ECI, and 86% had no experience using the

greenbook they subsequently took to the field). O/Cs indicated they were least prepared to enter data in a form they created (average response = 3.69), and to cut and paste references from the ARTEP library (average response = 3.69).

O/Cs indicated both the keyboard and pen methods of data entry, editing, and system operation were "easy" to use. A slight preference for using the pen was expressed (they had more experience using the pen in training). On a 5-point ease of use scale, the average response to questions covering five computer functions was 4.09 for the keyboard, and 4.20 for the pen.

The *Form-Builder* software functioned well in training (>75% of the time); and was considered easy to use (average response on a 5-point usability scale covering three software features was 4.17, or "easy" to use). O/Cs expressed relative satisfaction with the appearance of the data collection forms they were able to create (average response = 4.00), tools available to create forms (average response = 3.92 which is just shy of "easy" to use), and ease of using this software (average response = 3.85; also just shy of "easy" to use) to build data collection forms.

The *Form-Player* software functioned equally well in training; and also was considered easy to use (average response on a 5-point usability scale covering five functions = 4.31). O/Cs expressed satisfaction with the ease of data entry into preformatted forms (i.e. greenbooks; average response = 4.50), and ease of making changes (average response = 4.27). In fact, the average scores indicated the remaining four features were all considered "easy:" ease of entering data into forms they built themselves (4.17), making changes to list boxes (4.00), and locating fields (4.00).

ECI USE IN THE FIELD

All 12 O/Cs who tested the ECI in the field used the computer primarily inside their HMMWVs. Most reported having operated the computer while sitting in the front seat with the ECI on the center console; some placed the keyboard on their lap while trying to balance the CPU on the radio, or steering wheel. None attempted to use the ECI when on the move; this was determined to be impossible. One O/C reported having used the ECI outside in the open for a total of 4 hours over the course of the rotation. Two O/Cs used the computer under natural cover (under a tree, for example) for an average of 3 hours over the rotation. Four O/Cs used the ECI under man-made cover (inside a building) for an average of 3.5 hours over the rotation.

All O/Cs stored their ECIs inside ther HMMWV for the better part (average of 5.35 days) of the rotation. Most secured the computers inside its aluminum carrying case; other storage spaces

included inside a flight bag, inside an MRE box, and loose on the dashboard (between radio and mount). Only 2 O/Cs reported having stored their computer somewhere other than in their vehicle. One stored his ECI in his office for 5 days of the rotation, and carried it to the field for 4 days stowing it in his vehicle. The other stored his machine in the rear for 6 days, and carried it to the field for a total of 12 hours. Only one O/C reported having carried the ECI on his person for a total of 3.5 hours over the rotation.

O/Cs reported they were "prepared to use the ECI unsupervised" (average = 4.0 on 5-point scale); these ratings remained constant from the mid-rotation to ENDEX data collection periods. The ECI, in its present configuration, was determined to have "limited usefulness" to O/Cs (average usefulness rating = 2.5 on a 5-point scale); again, no increase in ratings was observed from mid-rotation to ENDEX.

O/Cs determined the keyboard was too small to suit them, and they did not like it being disconnected from the CPU; it was described as "extremely awkward to use" in this manner. Not being able to control the angle of the CPU/monitor also interfered with the O/Cs' ability to position the screen to avoid the glare of bright sunlight. A longer cord between the keyboard and CPU/monitor should have been provided, or a way to attach the keyboard to the monitor somehow, should have been provided. One O/C reported the flicker rate of his screen irritated his eyes (indoors and out) enough to significantly disrupt his work. The biggest complaint O/Cs had with the monitor was that it was extremely bright, violating the light discipline of BLUEFOR unit (see previous section on *MMI Hardware Requirements*), and potentially giving away their positions.

O/Cs reported the keys on this subnotebook computer were too small for their fingers, and they found the untraditional placement of the keys (required to fit them all in such a small space) awkward to use. The O/Cs expressed a strong desire to test the handwriting recognition software. The pen provided in the field test could then have been used to its full potential. Since the ECI was not equipped to read handwritten notes, O/Cs used the pen mostly as a pointing device. Many felt a trackball would have filled this purpose better than the pen which proved to be somewhat delicate (the tether was made of string and became detached in a few cases; the fuses blew out in another).

Software issues raised include the following. Overall, the greenbook software was described as easy to use. The biggest problem encountered was difficulty in scrolling through the lengthy electronic documents. O/Cs disliked only being able to view 1/4 to 1/3 of a page at a time, and pointed out the comparative ease of scrolling through the paper greenbooks. This is not surprising given the small size of the computer in comparison of the large size of the greenbooks. However, the task of finding an optimal way for a user to move through these large electronic data collection instruments (employing techniques such as condensing text where possible, and arranging sections in hierarchical fashion) is only a software challenge, and not an impossibility. A few O/Cs were dissatisfied with the way their greenbook data entry files were set up. Those with 10 separate files to access, instead of one per each of 3 missions, experienced difficulty in finding their way through the document [this is the same greenbook which contained 3 corrupted files].

The O/Cs very much liked the Windows operating system; found it easy to learn, and easy to use. Some O/Cs complained they had difficulty selecting some of the small icons (arrow was mentioned); this problem could be partly explained by lack of experience using pointing devices.

Most O/Cs did not build their own data collection forms for field use. This omission was not due to a lack of interest; rather it was attributed to a lack of time, and an accompanying lack of skill in using the software.

O/Cs were unanimous in their desire to have access to on-line doctrinal references. Most said they would have used Field Manuals (7-8, 7-10, 7-20, 100-5, 101-5-1) pertaining to Light Infantry doctrine if it had been available. The ARTEP covering Armor operations was only minimally used in the field during the rotation and, therefore, not much feedback was provided on ease of using this software module.

TECHNICAL DIFFICULTIES EXPERIENCED

Five of the twelve O/Cs (42%) who used the ECI in the field experienced technical difficulties. The vast majority of problems encountered were attributed to hardware failure. The automatic suspend mode did not function properly causing corrupted files on two different ECIs. The result was loss of access to the computers for 8-24 hours, and a "significant loss of work" on the part of the O/Cs. Two O/Cs experienced difficulty keeping their batteries charged; in one case the problem was attributed to a non-functioning power adapter. This individual experienced a 12 hour delay in access to his ECI until he could obtain an alternate source of power. The second O/C

used his cigarette lighter adapter until the fuse blew. Up to this point he experience a "significant *delay* in work" of approximately 3 hours, and a "minor dupliation of effort." Since he had no replacement fuses, he lost an additional 48 hours until he could regain access to his computer. During this time he missed data collection opportunities which could not be made up, and characterized the outcome as a "significant loss of work." One O/C's keyboard became detached repeatedly from the CPU causing the system to "lock up" repeatedly. He reported losing 15 minutes per an undetermined number of episodes. The only software problem reported was a single greenbook (completed by two O/Cs) which contained corrupted files (1, 3 & 6 in the Armor book). These O/Cs could not enter 30% of their greenbook data; a loss they described as significant.

CONCLUSIONS

The hardware tested in the field during rotation 94-5 was not found to operate at maximum efficiency. Most O/Cs reported they used the electronic equipment not more than a few minutes a day. The O/Cs who reported greatest use of the ECI encountered the most problems: 3 of 7 incidents reported came from the same O/C team. It is reasonable to extrapolate from these findings that the overall problem rate observed would have been higher with increased machine usage.

The hardware configuration of the ECI demonstrated in the field was not optimal for either O/C echelon group: it was too small to meet the needs of company/battery level O/Cs; and not rugged enough, or equipped with enough battery power to suit the platoon/section level O/Cs.

The software configuration demonstrated met some of the O/Cs' needs. With some additions, it could be very well support their information, and MMI requirements. The COTS operating system (*Microsoft Windows*) was rated as excellent, the *Form-Builder*, and *Form-Player* software was considered good (though additional training was deemed necessary), the doctrinal library was determined to hold great potential; it needs to be tailored to support Light Infantry doctrine. A graphics package needs to be added; the ideal application would include a *very basic* overlay/sketch capability. And a basic word processing application needs to be added which can be transferred to a desktop computer in the rear either by means of a floppy disk drive, or by direct connection of field CPU to desktop PC (complete with printer) in the office.

Recommendations

The following recommendations are forwarded based on the feedback obtained during the ECI field test conducted during rotation 94-5.

1) If and when the decision is made to purchase ECI equipment at the JRTC, distribute the field computers at company/battery level and *not* at echelons below. Both company/battery and platoon/section level O/Cs should enter relevant data including greenbooks in the ECIs assigned to the company level O/Cs. However, at some point, when technological advances provide suitable hardware (a rugged, compact computer) and software (good handwriting recognition software), examine the feasibility of employing ECI equipment at the platoon/section level.
2) *Hardware:* recommend a larger, "notebook" size computer which would include ports for a standard size keyboard, monitor, and printer for use in the rear [office]. Include a pointing device; perhaps a trackball would be better than a pen if it is more survivable (no way of knowing without testing). Provide 24-hour per day support during rotations.
3) *Software:* Keep the *Form-Builder* and *Form-Player* software providing the following improvements. An adequate training period is greater than one day in length; improvements to the Form-Player software must be made to account for the large size of the JRTC O/C's primary field data collection instrument (the greenbook), and 24-hour per day training support must be provided during rotations. Add a graphics package which would produce basic text and graphic slides (for AAR, and administrative uses). Highly recommend pursuing the *very basic* overlay/sketch drawing tool to support the sharing of operational and other graphics in the field. Ensure word processing capability, which can be brought to the rear by some means, is provided.
4) Need to address how much, and what type of data collected on the ECIs could actually be shared. Some restrictions will apply based on configuration of the IS database (currently in development). O/Cs will need to be informed what can be shared, in what format, and exactly how the data transmission would be performed (see next bullet).

5) *OCCS:* need information on how the ECI's digital interface with the OCCS would be accompished. Would the O/Cs' hand held radios be involved? If so, how easily could the radio switch from voice to digital mode and back? And what degradation in either mode would be observed on the system, if any?

TRAINING ROSTER

Date	*O/C Division*
7-8 March	Brigade C2 / Armor
	Task Force 1
	Special Operations Detachment
	Air Defense Artillery
9 Mar	Task Force 2
	Fire Support
	Combat Service Support
	Task Force 3
	Intelligence
	Brigade C2 / Armor
	Task Force 1
	Aviation
10 Mar	Task Force 2
	Intelligence

AMOUNT OF COMPUTER EXPERIENCE BY CATEGORY

Response Options by Category	Percent Responses
Word Processing	
No experience	14%
Have used a word processor	50%
Extensive word processing experience	28%
Extensive word proc. and desktop publishing experience	8%
Data Analysis	
No experience	41%
Experience using spreadsheet, or database software	48%
Extensive spreadsheet or database software experience	7%
Extensive experience using analytical software	4%
Graphics Applications	
No experience	29%
Experience using graphics software for text slides	54%
Other graphics products, e.g. objective sketches	15%
Extensive experience with advanced graphics & layout	2%
Level of User Interface	
No experience	19%
Basic level understanding of how to operate a PC	64%
Command of >1 operating system, or programming exper.	17%
Degree in computer related field, and extensive experience	0

Training

Had enough training to be able to operate machine in field.

Training was adequate for the way I used the ECI--so far, only entered greenbook data.

Need more training. Need more supervised practice creating forms.

Training was inadequate.

Training should have been more in-depth.

Two days of training not adequate.

Training a little fast paced.

Performance oriented training okay, but needed practical exercises (build own form and show teacher--see the end product *in training*).

Some of the instruction was at a higher level than fit the audience [from an O/C who has taken computer classes, and is fairly computer literate].

Will turn machine in without having ever seen the end product; won't be able to report to superiors what it looked like.

Received no instruction on how to use greenbook [which was complex: contained 10 files].

Tried to make own form in the field but could not get it done.

Could not make the some features of the Form-builder work when tried it in the field. Some things were not shown in class.

Forgot how to perform some functions while trying to build a form at an inconvenient time to contact trainer. Never got to finish the form.

ECI configured with room enough for one phase worth of data; never did get phases two and three data into machine.

Is there a help file? Think so, but disabled.

Wanted a hand out to cover at least topics covered in training (include function keys).

Information Requirements

Very interested on the whole.

Don't feel ECI saved any time.

Would use the ECI, to a limited degree, as presently configured the way we use current laptops.

Tried to use it for all data collection needs; built 11 forms. Did BOS (AAR) slides on it.

Used machine 10-15 minutes per day.

Used the machine for a few hours per day--typically at lunch. Frankly didn't have much time.

One window from about 1100-1400 in which to use the computer.

Used ECI once since mid-rotation. One reason I didn't use it much is because of security; kept the machine under double lock in the rear.

Could not access machine when had time to use it; lost ECI when driver (and vehicle) departed at 1700 hrs daily.

Could use computer during only one mission when had access to the vehicle; during other missions requiring [O/C] to be away from vehicle could not use ECI *at all.*

Only for O/Cs who are tied to their vehicles who can secure and power the equipment.

Anyone who has a vehicle could be issued an ECI (i.e., down to Platoon level).

Not feasible for Sr Plt O/C on the move. Plt O/C would use ECI in his vehicle if the software transfer to *Enable* was seamless and it had a floppy disk drive to facilitate transfer of data to computers in the rear.

Each Sr. O/C should have an ECI. However, echelons above Company level would have no need for ECI since they have entire TAFF at their disposal--have staff to chase down any needed information.

ECI could be useful for tracking data important to the Sr. O/C (number of NODs utilized) and transmitting it to the TAFF.

If the ECI could be attached to a kneeboard, Aviators would use it (CPU and pen only) in the air to relay BTO data, send contact reports, accident reports, medevac requests, and other messages. This would keep the voice radio net open for other critical, to include emergency, traffic. Would like to have screens to store information at a glance such as: bluefor call signs and frequencies, local call signs and frequencies (such as the tower at England ISB, and the tower at Ft. Polk).

Can't imagine using greenbook data in platoon AARs. Would prefer to call fellow O/Cs over OCCS for information rather than download data from IS database.

Armor Division could report unit locations using ECI, could definitely collect and report data on deadline problems, maintenance status, and personnel status over the ECI; *never* contact reports.

For exercise control the Armor Division would access CSS, Bde C2 screens, and the larger IS database to exchange information.

Would like to be able to display greenbook data on larger screen so Sr. O/C can review before distributing to TAFF (pulls ideas for AARs).

Computer method of entering greenbook data would allow O/Cs flexibility of evaluating the same tasks, subtasks, or standards over multiple iterations (to look for improvements in performance within a rotation). Often O/Cs observe unprepared units making progress over the rotation and currently don't have an objective way to support this claim.

Downloading data for AARs could be a real benefit [Armor].

Don't think Platoon O/Cs would access data other than MTP references for their (field) AARs.

Including a Ft. Polk map on the ECI on which O/Cs could draw and transmit graphics such as sketches (objective or contacts), and operational graphics.

Don't think O/Cs will ever get away from handwritten notes. Machines can't match the convenience of note taking by hand (during staff meetings, for example).

Would love ability to transmit graphics such as objective sketches, intel products, operational graphics, etc. back to the TAFF.

If ECIs could talk to each other, would like to have option of sending data/graphics to alternate POC, or Sr. O/C in the field.

Desired capability would be for any O/C with an ECI to be able to create a map graphic and transmit it to the TAFF and be able to download a map or graphic created at any echelon (e.g. Co => Bn => Cos).

Would use IS data for Company (field) AARs.

Had no need to do THP in the field.

Would write draft THP on ECI.

Could use ECI for THP.

Would have done THP in the field, if form was available, and complete final edit in the rear after ENDEX.

No interest in doing THP on the small ECI keyboard. Would use it in the rear with larger keyboard.

Have done no THP preparation on ECI; no need to.

Haven't used ECI for draft THP yet. Maybe no time since this rotation am spending more time away from vehicle.

Storing FMs on-line would assist in preparation of THP.

Would have used doctrinal references, if available.

Doctrinal references (MTPs/FMs), and ability to do THP in the field are the greatest strengths of the ECI.

Regulations and FMs would be a useful addition to the library.

Would use MTP library if could tailor it to our needs [from the Division whose ARTEP *was* loaded on the system].

Would have used the doctrinal references, if available.

Did not pull anything out the ARTEP library; didn't have time. Wouldn't use that much for insertion into the greenbook.

Would use graphics capability for perimeter sketches and operational graphics, for example.

Since SOD has own TAFF they had no need for own forms on ECI.

Add a spell checker.

Want the ability to create a log form which allows entries to be made real time, or after the fact (e.g. at shift's end, or days later). Present data field did not allow this flexibility; forced into real time entries only.

MMI Issues

HARDWARE ISSUES

Present weight (5-7 lbs) no big deal for overall weight. If ruggedizing adds some weight it would be worth it.

Size okay; configuration of hardware "no go."

A system which is a few inches larger all the way around would be ideal for use in a HMMWV.

Current size of the CPU not bad; would fit in the pouch of ruck easily. Was afraid to do that because the machine was too fragile.

Kept ECI locked in footlocker of vehicle to secure it.

Worried about damage or theft of the ECI.

Experienced no batteries, or technical difficulties whatever.

Battery life good.

Battery life must extend the length of one mission (about 36 hours) in any weather condition.

Batteries did not last long enough, and were not easily rechargeable. Don't think batteries would last long away from vehicle (i.e. away from the recharger).

Make ECI run off a lithium battery, or AA, C or D cell batteries which are readily available to military personnel.

A couple of nights wanted to work on the machine, batteries low so shutdown. No access to HMMWV to recharge. Had to discontinue work.

Greater battery life would be useful.

Blew fuse, had battery problems. Batteries would not hold charge.

Kept the ECI out of its case nearly the whole rotation for ease of use; seems to have held up just fine.

Realize ECI not ready for field use; not ruggedized.

Don't think ECI could be made rugged enough for field use; already have a laptop in vehicle.

Screen needs to be more rugged; already scratched (at mid-rotation). With extended use would certainly become scratched, decreasing readability. Feared could easily be broken.

SOD O/Cs do not rotate shifts; they go out for the duration of the rotation. Often they do not have access to their vehicles; hence, if the ECI is not rucksack portable, it would not be used by SOD O/Cs.

Do not ship as is. ECI must be ruggedized and waterproof. Definition of rugged = rucksack portable (ability to withstand the weight of two adults sitting on it). Definition of waterproof = able to withstand the amount of water collected while sitting under a poncho in the pouring rain.

Concerned about ruggedness of *case* since the ECI is not ruggedized. A rugged case which would attach to a HMMWV is needed.

Can't damage the CPU in the case.

If the ECI was weatherproof would be valuable for storing FMs.

Carrying case a no go! Could use more if had pen working (handwriting recognition software available).

Case too bulky, but very rugged.

Being able to carry only the CPU and pen (if pen software was enabled) would increase utility of the ECI.

Need to be able to prop up the CPU so can see the monitor.

Very clumsy trying to use ECI while sitting in the HMMWV.

Need to be able to prop up the CPU/screen so it can be seen.

Inside my vehicle had trouble seeing the screen. The flicker rate produced diamonds; had to rest eyes, return to the work frequently.

Used the ECI at night; light created an enormous signature (worried it would give away their positions).

Night had more time to use computer but could not because light signature too large.

At night we used the ECI as a *flashlight* (on suspend mode).

Screen too bright at night even with a hat on it. Could see my reflection in the windshield.

Cable from CPU to keyboard too short reducing ability to prop it up so it can be seen.

Get rid of the keyboard or attach the keyboard to the CPU; imperative to have a compact package.

ECI not useful in two pieces *anywhere in the O/C Division* (neither the O/C nor bystanders were enthused with the prospect of juggling the two halves).

A two-piece ECI might make sense if the handwriting recognition software was used.

Cord attaching keyboard to CPU too short; or replace hardware with traditional laptop configuration.

Want the CPU and keyboard attached.

Would prefer the keyboard and monitor be attached.

ECI would be more useful if in one piece (keyboard attached).

Would like a way to prop the CPU up so screen can be seen while using the keyboard.

Need a "dummy cord" (a loop which connects the computer to the body in case the soldier needs to get up and run).

Snap which held the pen came loose.

Don't think HMMWV part of the lighter adapter ever worked; ran down 2 batteries.

Batteries would not hold their charge; the cigarette recharger *saved* me. (Need good batteries like those provided with the OCCS).

Pen seemed too fragile; too easily damaged or detached. Could not operate the pen if wearing gloves.

Pen clip broke; lost pen for days.

Need a better way of securing the pen to the computer.

Had to hit the pen four or five times to access the main menu; after that it worked more smoothly.

A trackball might work better than the pen.

Would prefer a trackball to a pen.

Voice activation, or touch-screen methods of data entry might work better than the pen (which is easily detached and lost).

Keyboard too small for me.

Prefer keyboard method of data entry.

Found keyboard difficult to use with some keys in non-traditional places.

Want a 3.5" disk drive.

Desire print capability.

Would like the peripherals integrated; didn't like keeping up with so many [extra battery, charger, cords, etc.]

What impact would data transmission over the OCCS have on that system? Would it decrease the speed of either voice, or digital transmissions? Also, would the transmission of digital information over OCCS involve the O/Cs' OCCS radios? If so, how easily could they switch from voice to digital mode and back?

SOFTWARE ISSUES

No difficulty scrolling.

Slow to turn pages.

Liked the pen keyboard; would like it more if it was increased to fill half the screen.

Would like an easier way to scroll through questions. First page brings up questions 1-14; thereafter must scroll to view desired questions. Would like the ability to specify which questions will be included in the display (15-29, for example).

Want a seamless transfer of data from ECI to word processor (for THP, for example).

The arrow icon used to turn the page is too small.

CPU slow, too slow.

Slowness of the CPU a problem.

The software was easy to learn in terms of basic operation and greenbook completion; the forms were more tricky.

Need handwriting recognition capability.

Handwriting recognition software would help.

Should have enabled handwriting recognition software.

Remove capabilities not enabled to free space on hard drive and increase processing speed.

Software was user friendly, had no problems using even though training was inadequate.

Keep windows; easy for an infantryman to learn quickly.

Like the software; only an imbecile could not figure out how to use it.

Showed ECI to guys on O/C Team; they had easy time understanding and using system (software).

Played with making own data collection form to collect THP data; after lost greenbook data decision was made for me *not* to put THP data in ECI.

GREENBOOKS

Would prefer electronic means of carrying greenbooks to the field; the paper version is of intimidating size, plus don't like to get them dirty or wet.

O/Cs would prefer to enter greenbook data in the electronic versus paper format; it feels less like work.

ECI useful for greenbook data entry but slower because it is too large with the carrying case: only have access to vehicle about once per day [where machine is stored].

Find it helpful to have greenbook on ECI. Usually don't carry greenbook to the field; brought this one because it would be protected [in the computer] in the case.

Faster to do greenbooks with paper and pencil.

Would rather enter greenbook data on ECI than paper, but paper is much faster.

Would prefer not to use ECI for greenbook data entry because of the size, weight, and comparative lack of portability in comparison with the paper version.

It's hard to beat the paper greenbooks which are very portable.

Took longer to complete greenbook than paper form.

Configuration of [Armor] greenbook software was untenable; had to access 6 different files to enter data for the attack mission, 4 files to enter data for the LIC phase, and 5 files for Defend. This arrangement made it difficult to navigate through the "greenbook."

Having greenbooks on computer would be tremendous. Would allow O/C Divisions to tailor greenbooks by mission (delete tasks which do not apply to a particular mission, for example).

Greenbooks need to be configured so that there is a maximum of one file per mission.

HOW TO FIELD ECI

Fire Support: Distribute one machine to each of approximately twelve three-man teams.

Special Forces (SOD): One computer per each of six O/C Teams; one per each of two ODBs; and four more for Sr. O/C, S4, S3, and S2 (total of twelve).

Task Force 3 (CPX): is in the process of automating their CPX operations at North Fort; perhaps won't need a stand-alone data collection system at all (understand CPX computer will already have a direct link with IS).

Brigade C2–Armor: For each [of 2?] Tank Company, distribute one computer to each of four Sr. Plt O/Cs (each of whom complete one greenbook per mission with their Plt Sgt), and one to the Sr. Co O/C. Don't see a need for ECIs at section level.

Aviation: One ECI per each of eight 2-3 person O/C teams. (Team members are always together). Need additional machines to cover break downs: need access to replacements any time of day on any day of the week.

CSS: One ECI per each of 6 O/C sections/teams (each computer would contain all five greenbooks completed by the section).

Task Force 2: Distribute ECI to each of 3 Sr. Company O/Cs *only*. Platoon O/Cs could enter their greenbook data, and extract doctrinal references from their Sr. Co O/C's machine. Higher echelons have access to all the computers and staff in the TAFF.

Additional comments about the keyboard method of data entry

Keyboard was used very little

Need more practice using the keyboard

Keys should be more conical in shape so fingers can find keys without looking
Would like raised dots on the "f" and "j" keys
Should have the option of changing windows using keyboard commands which would be quicker than using pen.

Additional comments about the pen method of data entry

Would like to have a trackball to take the place of the pen

Add a trackball to the keyboard

Add the handwriting recognition software

Would be nice if handwriting recognition would be available

Need handwriting recognition software to allow O/Cs to do away with the keyboard at times (i.e. during movements, or halts); would be worth it despite training time needed.

Recommended changes to the form-builder software which would make it more suitable to build the kind of forms O/Cs need

I have working knowledge of HG3; the forms we made in training I think I can make for our use in the field.

You should be able to change the form (i.e. add/delete a field) without losing all your data.

Add a Take Home Package format

Want to ensure the format (text and fonts) of downloaded forms are *identical* to what I build using the ECI. Currently, what I build may not be what I get when transferred to a 3.5" disk in ASCII format.

Additional tools required to build forms O/Cs need

Would like to be able to align boxes

Graphics capability for objective sketches/contact sketches. This would not only reduce time for O/Cs moving to the TAFF for graphic depiction but also it could be useful for my own AARs/PAUSEXs (in the field).

Changes or additional capabilities needed to build forms O/Cs need

An additional sort capability would be nice, as to arrange things somewhat differently.

Add a checklist capability

Excellent tool

My concern is not with the appearance of the forms I built in training (which are satisfactory). I am concerned about how the forms would look when sent to the TAFF. This is the most important aspect: will my forms be useful to others when transmitted via digital interface or when downloaded to a diskette?

Recommended changes to form-player software to facilitate data entry

Turn on handwriting recognition function

When copying lines from the MTP, would like the reference (i.e. chapter, page no., etc.) to be automaticlly annotated at the end of the line.

Move the overall evaluation block at the *end* of each task (rather than at the beginning); Move the overall comment block at the *end* of each task (rather than at the beginning)

Recommended changes to form-player software to facilitate locating data fields

Would like to be able to add more one-word entries on index box.

It was somewhat difficult to place the pen in the exact location necessary to change the size of the boxes and to copy boxes from inside the fields.

Additional uses for word processing in the field

Would use to take notes for AARs or THPs

Copy, cut, paste capability for the movement of the MTP to the greenbook

Have BDA call up capability

Take Home Packages

Draft slides would be made in the TAFF with data provided by field O/Cs. It is easier to call in the data by voice (OCCS) to the TAFF and let them do the data entry work, especially during movements, contacts, and times of poor visibility and bad weather.
The slides produced by the ECI for field AARs would be enhanced by visual/graphic presentation.
Draft THPs are a distinct possibility for ECI use because the machine is so portable. This advantage would hold only if paper copies could be provided for Task Force review; format changes in downloading could pose a problem.
ECI not useful for administrative purposes due to small keyboard being not as friendly as a full size desktop computer keyboard.

Additional uses for graphics in the field

Doctrinal slides, *Admin:* field notes

Admin: change unit briefing slides

Flight routes of enemy aircraft; unit symbology

Ability to view AAR slides prepared in TAFF for possible inclusion in field AARs

Need graphics capability to send useful draft AAR slides to TAFF
Could make field AAR slides with training
Would use ECI to send ops graphics to TAFF; would use it for ops graphics for field AAR use only if graphics could be enhanced in TAFF first (then transmitted to field)

Recommended doctrinal references

All SOD specific references, i.e. DA, FID, SR, MTPs

Armor FM 71-123, FM 17-18, FM 17-15

Rifle Co FM 7-8, FM 7-10, FM for Air assault, FM for Rangers

FM 44-100 and applicable FMs for Air Defense, and operations in light/special divisions

CPX FM 101-5-1, drills manuals, FM 7-10, FM 7-20, FM 7-8

Armor FM 71-1-2-3

ADA FM 44-16, FM 44-64, symbology

Rifle Co FM 7-8, FM 7-10, FM 7-20, FM 100-5, 101-5-1

Rifle Co FM 7-8, FM 7-10, FM 7-20, MQS manuals, branch specific skill level I & II, drill manuals

Aviation STP como, skills level 2-4, and FMs approximately 4-6

Rifle Co an FM library for each division: MNVR= FM 7-8, FM 7-10, FM 7-20, etc.

Intel FM 7-8

Additional software requirements

Need doctrinal references for FID to encompass mission specific areas, i.e. Sniper Ops

We don't use multimedia in the field at our level

Harvard Graphics; handwriting recognition software

Spell check

Add GPS ability, i.e. display map, show exact location, place "called in" locations on map. Print map or save showing exact locations vs. "called in" locations. If GPS not available, then add ability to place unit symbols on a map.

Map overlays to send to TAFF

Ability to transmitt data to TAFF vs driving all the way back; this would prevent us from leaving the unit without O/C coverage

Increased monitor size would improve ease of use especially for an graphic purposes

Need longer battery life

Need surge protector built in to handle electrical surges of vehicles (HMMWV)

ECI would be less awkward to carry if monitor fit onto keyboard

ECI components (i.e. batteries, charger, inverter boxes, etc.) should all be part of the system; cumbersome to carry pieces around

Need a longer cord between the keyboard and monitor; ideally telescopic

Need a map of Ft Polk, and Peason Ridge on the system

Recommended improvements to training program

Require more training time for users; at least 1 week

Training would be better if done one week earlier (in relation to the rotation). I am scheduled to receive my equipment one day before leaving for the field.

Allow O/Cs to prepare our computer for field use during training

Must wait until ENDEX to learn how to download data to diskette

Include an instructional booklet

Because an instructor was present I was not able to determine how user friendly/effective the "help" commands are

Currently most of the JRTC Operations Group does not own *Microsoft Windows* which will have to be purchased in addition to the software being developed by ARI.

How O/Cs used the ECI to prepare for the rotation

I will create 1 or 2 forms to try to use in the field

Collect greenbook data

Will not use it to prepare for the rotation

Set up the THP

Troop list, greenbooks, THP

Create forms for fixed-wing BDA/Eng.

I will not use ECI to prepare for the rotation

Will create form and worksheets (for what he did not say)

Format THP and Co Trends Reports

Tailor reports and data entry to simplify our duties; new forms should help both the O/Cs and the player unit

I will become more familiar with its functions and capabilities.

AARs for which O/C ECI participants provided input

Isolation and Execution (SOD) AARs

Tank Platoon and Company

All Rifle Company AARs, hopefully

TF2 Bn AAR, ADA BOS AAR

All CPX Bn TF AARs

Tank Platoon and Company AARs

ADA AARs

Rifle Platoon, Company, and Bn TF AARs

Fire Support Battery, Bn TF AARs

Rifle Platoon, Company, and Bn TF AARs

Aviation Company and [Bn?] AARs

Intel Team and Company level AARs

How O/Cs planned to use ECI for AAR preparation

As a database for execution slides for the SOD AAR

Plt: help brief what happened; Co: Let Sr O/C know what happened at Plt level

ADA BOS AAR: Use notes for data dumps

Fixed-wing BDA

Do not expect to use ECI to prepare for any of the above AARs

Plt: use of 7-8 and greenbook standards
Co use of 7-8

Additional Comments

Have yet to see my greenbook on ECI; have not been trained on greenbooks

Haven't seen my greenbook on ECI; received no greenbook training

Have not yet seen my greenbook; no training

ECI will have no impact on the accuracy of the data I collect in the field because the data is only mine. If the data went to a central source that everyone could access, then data collection would increase.

Did not enter data into a preformatted form (greenbook); have seen own greenbook on ECI (but did not open it or use it during training)

Know how to access ARTEP library; however, my ARTEP is not loaded on the ECI

Will not use ECI to prepare for CPX Bn TF AARs

Expects amount of time needed to prepare notes and other written materials in the field to be significantly less using the ECI.

Entering greenbook data in the ECI will probably take longer than the paper version of the data collection instrument. Paper greenbooks are easy to carry and easy to put down when I need to go. I am concerned about the time it will take me to go through shout down procedures and then have to secure the ECI.

I think using the ECI to prepare for the rotation will take longer than usual because of my unfamiliarity with the system and believed limitations of it at this time.

I plan on using the ECI for THP and greenbook data entry. For THP I see not advantage over taking my current laptop to the field. For greenbooks, it wouldl be quicker entering data by hand than by using the ECI.

Accuracy is only as good as I make it. It is much easier to jot notes by pen and paper during night movements, rain and no escape from adverse taerrain, etc. than to input data into a computer in the field. I see myself taking notes then logging them into the computer later.

The computer seemed slow moving from the initial "windows" screen to form developer.